AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

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For Sale Everywhere by Newsdealers.

ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

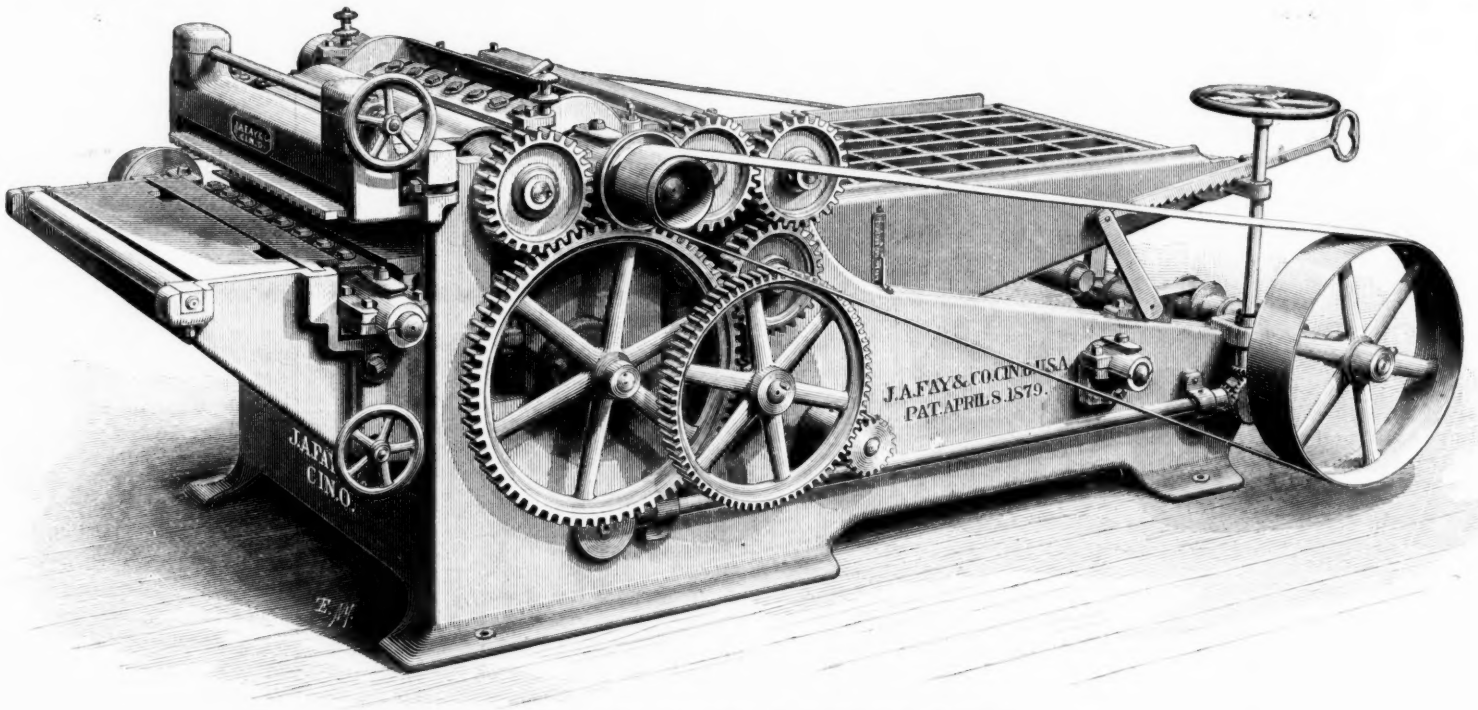
New Double Cylinder Roll Feed Planing Machine.

We present herewith an engraving of this machine, which is made by Messrs. J. A. Fay & Co., of Cincinnati, O. It embodies points of novelty in its construction which make it worthy of consideration. It is made to plane up to 30″ in width, and from ¼″ to 6″ in thickness. It is massive and heavy, the framing of the machine being made of heavy plate sides, with internal ribs. The joints are all planed, holes reamed, bolts turned, and every part thoroughly and carefully constructed, the object being to produce a reliable and powerful machine.

The upper and lower cutter heads are made to plane 30″ in width. They are formed with steel lips upon their faces, have cast steel shafts, which extend entirely through the heads, with the journals finished in the very best possible manner. The upper head remains stationary, the bed raising and lowering to suit the thickness of the material. The under cylinder is easy of access for convenience to the operator, as the upper housing, carrying the pressure bar over it, is made to swing entirely out of the way. Both cutter heads are belted on each side, although the engraving shows the latter belted upon one side only. The lower cutter head runs in connecting bearings, and has a vertical adjustment with the platen or bed.

Pressure bars are placed close to the cut upon either side of the lower cutter head, also a holding down bar above it, which by unloosening a hand nut, can be instantly swung entirely out of the way, affording ready access to the cutters. Yielding pressure bars are also arranged upon each side of the upper cutter head; that on the leading in side is attached to swinging arms, which allows the edge of the bar to work close to the cutters, which prevents tearing and splintering in cross-grained lumber, and can easily be raised up for securing access to the thickness of material to be worked, by means of a hand wheel at the end of the machine.

Altogether the machine is well adapted to do first-class rapid work, and for continuous and hard service.



NEW DOUBLE CYLINDER ROLL FEED PLANING MACHINE.

Machine Shop of the Pittsburgh Locomotive Works.

The plan of the Pittsburgh Locomotive Works is arranged in a manner that provides excellent means of transferring work through the different shops with the smallest possible amount of handling. The grounds are in the form of a rectangle with the machine shop and offices occupying the whole breadth on the main street. Along the outside of the machine shop a transfer track is located and at right angles to this track the erecting shop, blacksmith shop and other buildings are built. This arrangement provides easy means of transferring all material to and from the various shops by flat cars. Cranes are provided all over the works for lifting heavy articles, so that nearly every operation of handling material is facilitated by power. The heavy tools in the machine shop are all located near the side transversed by the transfer table and convenient to the foundry and blacksmith shops, so that heavy material such as cylinders, driving wheels, frames, deck castings and similar articles have not to be conveyed through the body of the shop. The machine shop, as well as nearly all the other shops, is a one-story building lighted from top and sides. As far as possible the tools are arranged in rows with clear spaces between them, and tools devoted to the same kind of work are grouped together. One separate room contains all the machines working on bolts and screws, while another is devoted exclusively to brass-working tools. In walking round the shop we noted the presence of numerous tools that are of the very latest designs for getting out work promptly and accurately. Among these were several double-headed shaping machines, four-headed planers, multi-headed drill presses and different forms of grinding apparatus. They have a small hydraulic press for pressing in driving box brasses and performing other kindred operations usually done with a screw press. In drilling flue sheets they use the cutter described in the AMERICAN MACHINIST several months ago, and put 168 two-inch holes through a half-inch steel sheet in eight hours.

The vise bench, which extends continuously along one side and end of the machine shop, possesses several novel features. It is supported on neat, cast iron legs, made somewhat after the Brown & Sharpe style. Vises are placed eight feet apart, and adjuncts of each vise are a jointed gas bracket and a tool drawer. This drawer is supported in the center and is moved by an iron handle through which a bolt passes that holds a padlock. At the back of the bench a sheet iron shield extends all the way along with a wide angle iron on top which serves as a receptacle for the odds and ends handy to the machinist. Litter and dirt are conspicuous by their absence above and beneath this vise bench.

The shop is heated by steam pipes, the coils being placed above the vise bench. Every effort is made to arrange tools and appliances so that they will produce their full capacity of work; and every detail of the shop is kept in such a condition that the men are comfortable while doing their work.

Considering the natural protection which the British Isles possess against the danger from invasion of foreign foes, it is curious to witness the regularity with which John Bull is afflicted with panics of fear over imaginary dangers to the nation's safety. The latest trouble of this kind was started by the *Pall Mall Gazette* discovering that the British navy is in a dangerously weak condition, and serious apprehension ran through the whole country when figures were used to prove that the fleets of two combined powers could whip the British navy. The result of the agitation is likely to be that many new torpedo boats will be built without delay, and that private shipbuilding firms will be employed to do the work. The demand for this work comes in very opportunely, for it will give employment to many mechanics who are now idle in the ship-building centers. It would do good if we could get up a panic of the same kind in this country strong enough to induce Congress to avail itself of the dull times to make some badly needed additions to the American Navy.

Speaking of engines designed for special purposes in the United States, Mr. J. C. Hoadley in his paper read before the British Association, says: "A valuable class of engines used in steamboats, often with a single paddle-wheel at the stern upon Western rivers, such as the Ohio, which during a part of almost every year are in places very shallow, can only be mentioned. Horizontal, with cylinders about 25 inches diameter and 8 feet stroke, with poppet-valves moved by cams and levers, using steam of high initial pressure, and revealing by the shrill note of their exhaust a moderate degree of expansion, and running at

moderate speed of revolution, though with pretty high piston-speed—these engines afford a fine example of special adaptations to peculiar conditions.

Straw-burning engines for driving separators are largely used in the vast wheat and rye fields of California, and to some extent in the new Northwest, where there is no market for straw.

Erric's Portable Geared Hoist.

In the engravings, Fig. 1 is a full view of this hoist, Fig. 2 represents it with the hand-wheel and side removed, and Fig. 3 is a detached view of the other parts.

This hoist is self-sustaining, and is operated by an endless chain on the hand-wheel *W*. This wheel is keyed to a shaft extending through the side plate, the shaft having a small gear, *G*, made upon the inside end. This small gear gears into two other small gears, *E* and E_1, which are mounted loosely upon two fixed shafts. Made solid with these two gears are two eccentrics of equal throw, and mounted upon these eccentrics is the spur-wheel *P* and the arm *B*, which is solid with the spur-wheel *P*. When these eccentrics are revolved, the spur-wheel *P* receives an eccentric motion, but cannot rotate, being prevented from doing so by the arm *B*. This spur gear, being mounted upon an eccentric, is always in gear with a hollow internal gear, which is made solid on the periphery of the lifting-wheel *L*. This hollow gear having more teeth than the spur gear, will revolve only in proportion to the difference in the number of teeth. The hollow gear is solid with the load-wheel *L*, which is mounted loosely upon the shaft and carries the lifting chain.

In the one and two thousand pound hoists these chains carry two hooks, one on each end of the chain, so that when one is raised the other is lowered. The very heavy hoists have the two small gears, *E* and E_1, actuated by double screws on one shaft; these gears are keyed solid to the wheel, *W*, making a light and powerful hoist, which has the advantage of not having the entire weight resting upon the threads of the screws, and so liable to the accidents caused by the breaking of the threads, which so frequently happen on account of the oil being squeezed out from between the teeth of the worm wheel and screw threads, thereby causing the latter to be cut away.

This hoist is manufactured by Henry Erric, 1361 Ridge Avenue, Philadelphia, Pa.

Master Mechanics' Association—Investigation Circulars.

To the Members of the American Master Mechanics' Association:

Your Committee on Steel Castings for Locomotive work respectfully solicit replies to the following questions:

1. Have you had any experience with steel castings for locomotive work? If so, please say to what extent.
2. Do you believe steel castings can be used satisfactorily as a substitute for iron?
3. Does your experience with steel castings lead you to believe that the material is reliable under all circumstances?
4. What parts of a locomotive do you consider steel castings best adapted for?
5. Taking into consideration the first cost of steel castings how does the service got from them compare in cost with the service got from iron?

The Committee will gladly receive any additional information on the above subject you may have to communicate.

R. W. BUSHNELL,
JOHN BLACK,
T. J. HATSWELL,
Committee.

Replies should be sent as early as possible to R. W. Bushnell, Chairman of Com. M. M. B. C. R. & N. Ry., Cedar Rapids, Iowa.

1. Have any improvements in locomotive valve gear come under your notice? If so, name them, and, if possible, explain by sketch, tracing, etc.
2. Are such improvements patented?
3. What advantages are to be gained by the use of such improvements?
4. If a better distribution of steam is obtained, please illustrate this by indicator diagrams taken from an engine fitted with such improvements, as compared with others taken from an engine not so equipped.
5. How does the cost of construction of such gear compare with that of the ordinary gear? Please give figures obtained from actual practice.
6. Please illustrate, by figures obtained from actual practice, the difference in cost of maintaining such improved gear, as compared with the ordinary gear.
7. Have any improvements in the details of the ordinary link motion come under your notice? If so, please describe the same, and if possible explain by sketch or drawing.
8. Are such improvements patented?
9. What advantages are to be gained thereby?
10. If you can give any information bearing on this subject, and not covered by foregoing questions you are respectfully requested to furnish the same.

CHARLES BLACKWELL,
JOHN F. DEVINE,
M. M. PENDLETON,
Committee.

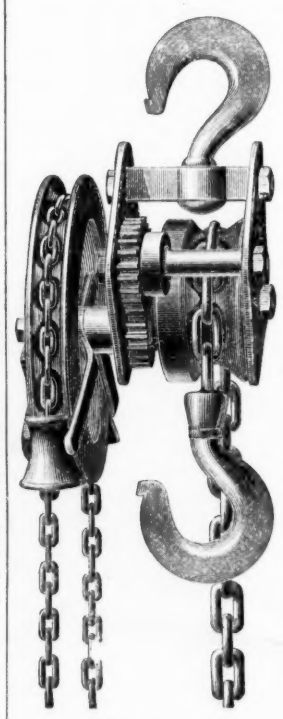
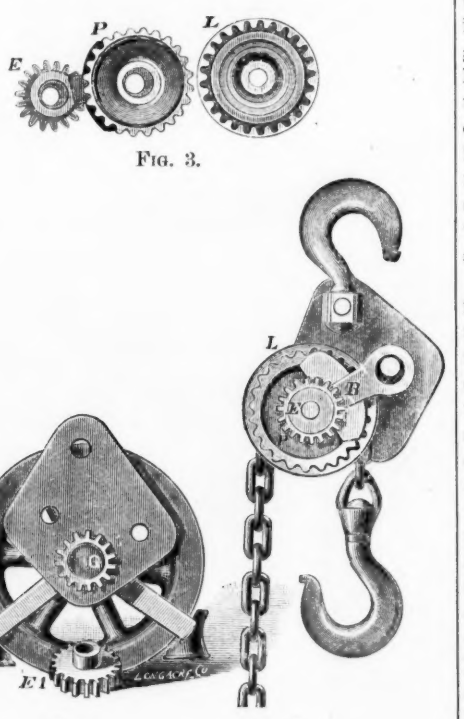


FIG. 1.



PORTABLE HOIST.

FIG. 2.

FIG. 3.

Rough Treatment of Boilers.

BY ANGUS SINCLAIR.

In to-day's paper I observed a dispatch from Minnesota announcing that six lives were destroyed by the explosion of the boiler of a threshing machine. I happened to be in the position to form an intimate acquaintance with the manner in which threshing machine engines were managed in the northwest a few years ago, and the surprise to me is why the boilers are so free from terrible explosions. The men in charge of that class of engine seldom had any training to prepare them for performing the duty of caring intelligently for steam boilers. There was no inspection by experts in steam engineering, the boilers were never tested, and the steam gauges were never examined unless they failed entirely to move the pointer, and the safety valve was generally held down by a steel lever that gave no indication of what pressure was put on the valve.

While sojourning in Wisconsin eight years ago, the writer was asked to examine the boiler of a portable engine used by a farmer to run a threshing machine. The boiler was of the locomotive type, of sufficient capacity to supply steam to an engine of ten horse-power. The duration of threshing time was about four months, and this boiler had been in use three seasons in a region where the principal supply of water was drawn from deep wells bored through limestone rocks. It had given perfect satisfaction till the beginning of the fourth season, when the seams and staybolts of the fire-box persisted in leaking badly. On examining the fire-box, I concluded that it was scale or mud-burned, and I asked the man in charge when the boiler had been washed out. He said he had taken out the plugs, but was not able to push a rod in, as the water space had got filled up solid. An interview with the proprietor elicited the information that the boiler had been blown off occasionally, but never washed out since it was new. When the fire-box and flues were tight the boiler seemed to make steam as freely as it ever had done, and there was very slight margin in its original capacity for supplying steam to the engine. Before the season of threshing was finished this boiler failed through the collapsing of a flue, and the boiler maker who was called in to do the repairs found the barrel solid from an accumulation of lime and mud. I lost sight of the boiler at that time, but I know a new flue was put in and the boiler set to work again, and I believe it would be kept going as long as room for any water remained, or till some of the sheets burned out when the opportunity would be presented for clearing out the lime deposits, unless they had got broken off in a more summary way by the boiler translating itself heavenward—by no means an unlikely consummation.

The peculiarly loose methods of attending to boilers are not, however, confined to the boilers supplying steam to portable engines. Mr. C. T. Davis, in his recent excellent book on "Steam Boiler Incrustation," mentions as a terrible example a case which we think by no means unparalleled. He says: "There now lie before me, as I write these words, the tubes which have lately been removed from a tugboat; some of them were bound together by one solid mass of stone-like incrustation, which, when cut away, exposed portions of the tubes eaten and burned completely through; the shell of the boiler in some places was almost in the same terrible condition, being so thin after the incrustation was removed that a strong kick with the heel of a boot would crush it. The same engineer had been in charge of the boiler from the time it was built until it was removed from the boat, and had paid particular attention to keeping the flues free from soot and ashes. A rigid examination of the record of the work that had been done by this boat, and a comparison of the quantities of fuel that had been used, showed in the three years that the boat had been running only a small additional consumption of coal in the latter six months over that of the first six months of the period. It is difficult to conceive that a boiler could be in a worse condition so far as incrustation is concerned, yet we find the increased consumption of fuel arising therefrom to be insignificant when compared with the loss caused by the destruction of the boiler, and the still greater extirpation that was momentarily impending to life and property."

There is not a railroad traversing the calcareous regions of this country but could testify from its official records that the increase of fuel consumption due to scale in boilers is surprisingly slight.

Trip on the Coventry Locomotive.

Through the courtesy of Mr. Carson, president of the Coventry Boiler Locomotive Company, a representative of the AMERICAN MACHINIST recently obtained the privilege of making a trip on the engine that was built for the company a few months ago by the Brooks Locomotive Works. As has already been noted in these pages, the engine ran for a few weeks on the Chicago and North-Western Railway, but she has now been transferred to the Chicago, Rock Island and Pacific Railway, where she is running a local passenger train between Chicago and Blue Island. It will be remembered by our readers that the Coventry locomotive has a return tubular boiler. The boiler is divided into two parts by a horizontal partition. The lower part contains 150 tubes running from the fire-box to the front end, and the upper section contains 80 large tubes passing from the front end to the smoke-box, which is behind, the smoke-stack occupying the position usually held by the steam dome. The boiler is very large, being 60 inches diameter. The gases from the fire-box pass through the lower tubes to the front end, and return to the stack through the upper tubes. The claim for this arrangement is that the gases, in traveling the long journey, will transfer more of their heat to the water than is possible with the ordinary locomotive boiler, where the gases of combustion pass into the atmosphere after once traversing the boiler.

The train pulled by the engine consisted of four ordinary passenger cars, and the double trip of thirty-two miles was made in about two hours, a stop having been made about every two miles. The engineer seemed to take particular pride in getting the engine away from stations so quickly that the conductor could not jump on the end of the train, and to do this he worked on the start with the reverse lever in full gear and the throttle wide open. The engine steamed quite freely, and the action of the blast on the fire was mild compared to that of an ordinary locomotive, but we could not see that the consumption of coal was materially less, although it is a difficult matter to judge of this by merely watching the fireman do his work. The water was carried extremely high—always near the top of the gauge glass, which reaches within a few inches of the top of the boiler. By this means the greater part of the return tubes would be submerged, and the opportunity for economical working would be given. From our observations during the short trip, we could not form a decided opinion as to the economy of the engine in its use of fuel, but we formed a decided opinion that the engine was one of the most perfect spark-arresting locomotives we had ever seen. It was quite dark before the train got to Chicago, and we watched the stack when the engineer was hammering the train away from stations, and scarcely anything in the shape of a spark could be seen. The engine will be tried on freight service against a Twombly locomotive. The same course will be followed as was pursued while testing the Walker smoke-consuming locomotive, which was exhibited at the Exposition of Railway Appliances last year. The management of the test of that engine was left to Mr. Twombly, general master mechanic, and he put her on to pull one section of a train containing 30 loaded cars to Peru, one of his own standard engines pulling the other section, which contained an equal load. This test was repeated several times, the coal supplied to each engine having been carefully weighed. At the conclusion of the trial it was found the Walker engine ran 33 miles to the ton of coal, and the Twombly engine made 39 miles with the same supply. When a test of this kind has been made with the Coventry locomotive, the public will be better able to form an opinion of her merits in generating and using steam.

Van Winkle's Power Meter.

This machine, illustrated herewith, was originally designed and constructed by the inventor, F. Van Winkle, 22 Cortlandt St., New York, for use in his own engineering practice, but finding a demand he has commenced manufacturing them for sale. It is, technically speaking, a rotary transmitting dynamometer, having as peculiar features:

1. The transmission and measurement of power by direct-acting pull springs.

2. Indication on a stationary index plate of the amount of load by positive mechanism.

3. An arrangement of the index plate to read off, without calculation, the number of horse-power transmitted.

The first of these—the distention of the spring—the inventor considers of the greatest importance in a machine of this kind, not only as doing away with friction, as where the spring must be guided against buckling, but as being otherwise more accurate than a spring in compression.

Referring to Fig. 1, the machine is represented as applied to measure the power transmitted by a pulley to a shaft, or *vice versa*. To facilitate the application of the machine, all parts which envelop the shaft are made in halves. *A* is a disk or face-plate fastened to the arms of the pulley by bolts and straps. Four set screws, not seen in the figure, pass through the sides of the boss of *A* against the hub of the pulley for centering *A*, and holding it concentric with the shaft and pulley. *B* is another disk, having a long hub *C* centered to the shaft, and held to it by four set screws at each end of the hub, as shown. The pulley is made free to turn on the shaft by withdrawing the key, if any, and slackening off the set screws. A split collar is placed on the shaft to the left of the pulley to prevent the pulley from slipping along the shaft away from *B*. Studs *D D* project from the disks *A* and *B*, and from these pull springs are suspended from one disk to the other, the only connections between the shaft and pulley to produce rotation of one by the other being these springs thus arranged. In Fig. 1 but one of these springs is seen.

Considering the shaft as the driver of the pulley, when the shaft is started the pulley will remain stationary, not turning with the shaft, until the springs have taken up the whole resistance of the pulley, thereby being elongated according to the load on the pulley. The amount of elongation of the springs is ascertained, while the shaft and pulley are in motion, as follows:

Two L-shaped arms project from the disk *A* over the periphery of *B*. To the ends of these arms light brass traverse chains are attached, which pass over the small guide pulleys on the back of the disk *B*, at *F* (in Fig. 1), and under, and are made fast to the larger pulleys, which are supported by brackets extending from the long hub *C*. These latter pulleys are connected to the sliding collar *G* by connecting rods, as shown. Hence, when the weighing springs elongate, permitting one disk to turn past the other, the traverse chains are taken up by the L-shaped arms of *A*, and the sliding collar *G* is drawn to the left. This sliding collar has a V-shaped groove, and a similar groove is turned in the end of the hub *C*. A stationary yoke carrying the index plate is dropped into the groove in *C*, and another yoke, guided laterally by the first, is dropped into the groove of *G*, to which is fastened the link for actuating the hand, as shown in Figs. 1 and 3.

The device is essentially a weighing machine, and as such has been designed with the view of measuring the load without frictional resistance. Practically, the only element of friction which could interfere with accuracy would be the friction of the pulley on the shaft, and the amount of power which can be transmitted by a loose pulley is nominally zero. In cases where the shaft is rusty, or the pulley is a tight fit to the shaft, before applying the machine the key or set screws may be withdrawn; power applied to the pulley will cause it to slip on the shaft, and in a few revolutions become perfectly free. A few drops of oil will reduce the friction to a minimum.

The driving springs are suspended from the stud *D* by eyebolts, screwed into cast-iron nuts, the latter being screwed into the ends of the springs, and the whole secured from accidental turning by lock nuts bearing on the ends of the springs. Undue elongation of the springs, or any compression whatever, in event of turning backwards, is prevented by stops between the disks. These are omitted in the illustration to show more important features. The pulleys attached to the connecting rods contain case springs for thrusting the rods to the right, and for taking up the slack of the traverse chain, which would be occasioned by a diminution of the power. As seen from the above, the whole load

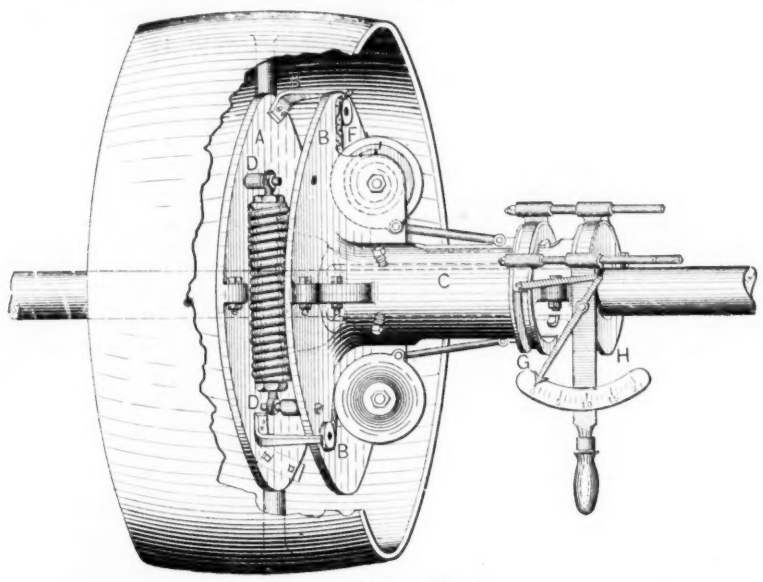


FIG. 1.—POWER METER.

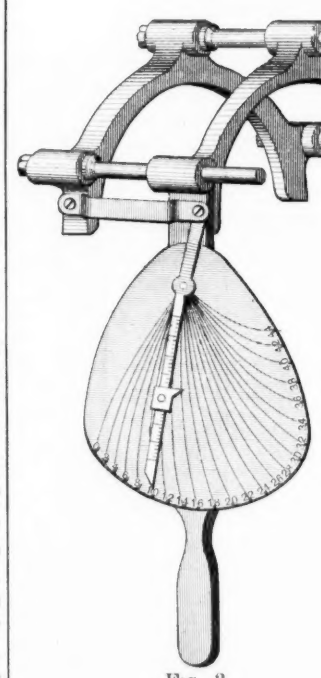


FIG. 3.

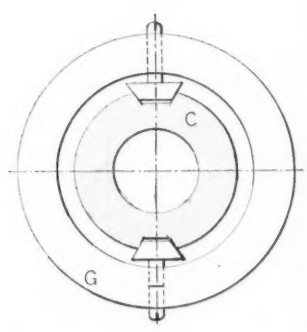


FIG. 2.

or power transmitted comes directly on the pull springs, with the exception of the very small resistance due to the case springs, which is actually less than $\frac{1}{100}$ of a horse-power at 100 revolutions per minute, and, as will be seen, is accounted for.

The springs are made of best spring steel of round section. Before being placed in the machine, they are subjected to 50 per cent. more elongations than allowed by the safety stops in the machine. They are then found to assume a set of about .025 of their original length. Other strains, producing lesser elongation, will then produce no set. They are then suspended from one end, and the other is struck quick blows with a heavy hammer, tending to elongate them, but not in excess of the first maximum elongation in the testing machine. After this severe test they are carefully measured, and if found to have assumed no set, and to give the same elongations for given strains as after the first elongation, they are set up in the machine. It may safely be assumed that a spring which will satisfactorily stand such a test may be relied upon, within its elastic limit, for accurate weighing. Fig. 2 is a section through the hub *C*, Fig. 1, and shows the manner of carrying the collar *G*. This is supported by brass shoes, sliding in beveled splines in the hub *C*. After the parts are assembled, the power meter is standardized, first statically and then by comparison with the chain brake.

For standardizing statically, the disk *A*, Fig. 1, is made fast to the face-plate of a lathe, and the disk *B*, by the set screws through its hub, is centered to a mandrel, supported between the lathe centers, and carrying also a pulley of large diameter. Knowing the number of revolutions per minute made by the shaft to which the power meter is to be applied,

$$\frac{33000}{\text{circumference of pulley in feet} \times \text{number of revolutions of shaft}}$$

will equal the number of pounds to be suspended over the pulley for each horse-power laid off where the hand may point on the index arc, as shown in Fig. 1.

As the work performed is directly in proportion to the speed of the shaft, in a portable power meter, in order to facilitate computations of powers at various speeds, in standardizing, the machine is assumed to make 100 revolutions per minute. For other speeds it may be computed where, for any given power, the index hand should stand.

Fig. 3 shows the method of constructing a dial plate from which the power may be read at any known speed. Instead of as many separate scales, like that shown in Fig. 1, the hand itself is laid off in arbitrary divisions, and carries a sliding pointer. The dial is standardized for 100 revolutions, the readings fixed being those indicated by the slide. Reading upwards, the divisions on the hand are points at which the slide is to be fixed by a thumb-screw for revolutions in excess of 100 per minute. As explained, it is computed where, at 100 revolutions, the hand should stand for indicating any given power at a given number of revolutions.

The hand is then held fast, and the slide moved until opposite the given number of revolutions, and the point indicated on the dial plate fixed as the indication for the given power. This is, in fact, only constructing a series of scales like that shown in Fig. 1. Indications for powers of the same value coming close together make a continuous curve, so that the scales for all speeds have a single set of figures. Obviously, the machine itself may be tested at any time by suspending the proper weights over the pulley to which it may be supplied.

Machines having two springs for transmitting and measuring 0 to 30 horse-power, at 100 revolutions, can be applied to shafts up to 3 inches diameter, and weigh complete 160 lbs.

The whole space required beyond the hub of the pulley is 20 inches. As seen from the description, they may be rigged to run in either direction, and, as the heavier parts are made in halves, can be attached by a millwright and helper in one hour, without disturbing shafting or pulleys. Many important tests, we are informed, have already been made with these machines.

The machine is simple in construction, and readily comprehended by anyone of ordinary intelligence. This coupled with the fact that the power being transmitted is read at a glance, will go far to popularize it.

Mr. Webb on His Compound Locomotives.

The following are extracts from a letter written by Mr. Webb, locomotive superintendent of the London & North Western Railway, to a friend in this country:

"It is strange how much it takes to convince people about anything new. We have run now nearly a million of miles of express work with the compounds, of which I have now got 30 on the main lines in regular work, and one in the underground in London, which is one of the standing type in use there, compounded. She has now run 14,000 miles with a consumption under 24 lbs., against the ordinary type uncompounded of 32 lbs. We have a test in two ways, thus, as we condense through the tunnels, and the temperature of the water in the tanks on arriving at the Mansion House the day I tried it was 162° and 175°, respectively."

"I have now got the first out of the large compounds, for our heavy night sleeping-berth trains, 14″ high pressure cylinders and one 30″ low × 24″ stroke in both cases. I never saw an engine shape better, or run steadier. You may write a letter on the foot plate at 60 miles per hour. Mr. Coleman Sellers, of Philadelphia, was here on Friday and had a spin with me on her, and expressed himself very much pleased, and he proposes to speak about her on his return, at the Franklin Institute.

"I am now bending the single throw crank out of a straight bar, in the hydraulic press."

Raw Hide Wheels.

In 1860, just before the war, the writer was employed to start a manufactory, one of the exactions being the construction of a machine for drawing and flattening fine brass wire. The connections of parts were first made by pulleys and belts—they did not hold; gears of necessarily very fine cogs broke their teeth; some were made of steel and hardened, but did not stand. The requisite appeared to be resistance and toughness of material. Raw hide was suggested; and some gears made of that material did their work well. Since then the use of this material has been noticed under similar conditions. Lately hydraulic compressed raw hide has been favorably mentioned as material for friction rolls and pulleys, for skate rolls, and as facings for friction wheels. There is no question of its advantage as a material for small pinion gears where much strain comes on each tooth; if not exposed to the continuous action of oil—animal oil especially—these wheels will bear a deal of rough usage. One of the useful qualities of raw hide is its yielding to a shock or sudden strain without breaking, and without giving a permanent backlash. Steel and the best of Norway iron will break under strains to which compressed raw hide will only slightly and temporarily yield. The teeth of raw hide blanks can be cut in the gear cutting engine as well as those of iron or steel, and the material can be more readily turned in the lathes. If a lubricant is required in the working, clear water is the best.—*Invention and Inventor's Mart.*

We frequently read of remarkable time being made in laying railroad track, building bridges, or something of that sort, but machinists are seldom credited with even the enterprise they may show in that direction. We note one recent example that ought to be recorded in their favor: James Brady, of Brooklyn, turned out one recent Saturday night to see his entire plant destroyed by fire, and on the following Monday morning had twenty of his machinists at work in a neighboring shop, in which he had temporarily rented tools and room. It is useless to say that one fire will not seriously interfere with his business.

Moulding Ammonia Boilers.

BY ROBERT E. MASTERS.

The sketches represent, in part, the moulding as done at the Columbus Iron Works of one of these boilers for an ice machine. The boiler is made in two parts. The lower piece is flat bottomed, is 10 feet long and 36″ inside diameter. The upper piece, the moulding of which is represented, has a dome-shaped top, is nine feet long and 36″ inside diameter. These are the sizes as they come from the foundry. One foot of the sink head is cut off each piece, leaving a flange 2″x2″ by which they are fitted and bolted together. The cuts refer to making the outside portion of the mould, which is struck up by sections in loam casings. The sections of this flask were made by using a heavy pulley rim pattern of the required size, and drawing it up to the length needed for a section. A flange 2″ wide and 1″ thick was cast around the outside at each end, and a rib 2″x2″ on each side the whole length of the section, and cored out with a loam core nearly cutting the casting in halves. After the pattern had been drawn and the cheek lifted off, the core was punched full of pointed holes to form points on the inside of the casing to hold the loam.

For this purpose we used a punch, shown in Fig. 1, and a punch board, Fig. 2. The board is ½″ thick and has holes just the distance apart to admit the points on punch. These points are 1½″ long. By placing the punch board against the core and punching through the holes it makes the points all 1″ in length, and an equal distance apart. As the board prevents the sand from breaking out, the work can be performed very rapidly. One section of the flask has a rim 4″ wide on one end to admit of a larger section being bolted on, to form the rim and sink head on the boiler. The sections of these flasks are all faced off on the flanges, and a center line is cut in the flanges to set them for striking up. The flanges and ribs are then drilled for bolt holes and guide pins by a template, and the section split apart.

Fig. 3, is an end view of section split in halves and bolted together. Between the points for holding the loam ⅜″ holes are drilled to permit the gas to escape.

The bottom plate, shown in section in Fig. 4, is cast 3″ thick on the rim as wide as the flask and flange, and 2″ thick in the center, leaving a recess of 1″ which is cast with points ¾″ long. The holes between the points in this piece are made by setting dry sand cores. A hole 2⅛″ diameter is cast in the center to let the sweep shaft pass through. This plate is also faced off on the rim, and drilled by template.

In making the flat bottom part of the boiler the recess, is filled with loam, struck off, and a light fire built over it, no brick being used in the bottom.

As shown in Fig. 5, at *B*, *B*, in striking up the dome, which we do last, on that piece, we brick up to form the dome, and they will not stand to be lifted off. Each section is struck up separately, except the two sections *C*, *C* in Fig. 6, which are struck up together to form the flange and sink head. As each section is struck up and lifted off the bottom plate, a sheet-iron basket is hung in and a light fire built in to set the loam. They are then finished, blacked, put together and bolted, the hole in the bottom stopped up, and the joints all dressed, as shown in Fig. 6, and it is then run in the oven to dry.

At Fig. 7, is a view of strike having two cutting edges. This strike is used on every part of the outside of the mould, except at *E*, in Fig. 5. As shown, the strike (Fig. 7), is set to strike sections *C*, *C*, Fig. 6. Reverse the strike and it is ready for the plain pieces.

In a future article I will present the construction of the core barrel and cope plate, and method of making core and casting boiler.

One of the German consuls in Russia says machinery is chiefly imported into that country from England and Germany, and, on a smaller scale, from Belgium. In 1882 a good deal more was imported than last year. Germany supplies principally steam engines and boilers, machine tools (in regard to these, in point of fact, Germany has altogether the upper hand in the Russian market), power looms for cloth, and machines for printing woven fabrics. From England everything is imported which is connected with the fitting up and keeping in working order of mills for the spinning and weaving of cotton; rollers for the printing of chintz also come from England. The only machines imported from France are those connected with silk manufacture and chocolate making, and a few for the printing of woven fabrics. An establishment for making power looms for the weaving of cotton was set up in 1883 at Podolsk, in the district of Moscow.

Writers on the progress of civilization are fond of expatiating on the accelerating influence of the printing press. During the last century the printing press has doubtless exerted a highly beneficent influence on human affairs by preserving and disseminating useful knowledge; but for several centuries after printing was invented its power was extremely limited. The art of printing was invented about the year 1450. The earliest representation of a printing press occurs in books printed by Ascensius. It is an indisputable fact that no improvement was effected on that press till about the beginning of the present century. During the period of 350 years from the invention of the printing press till the first improvement was made some departments of the mechanic arts retrograded rather than advanced. The application of steam to motive power was the spirit that put new life into the world of progress.

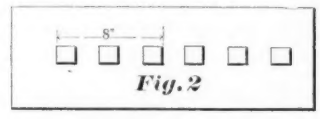


Fig. 2

Fig. 1

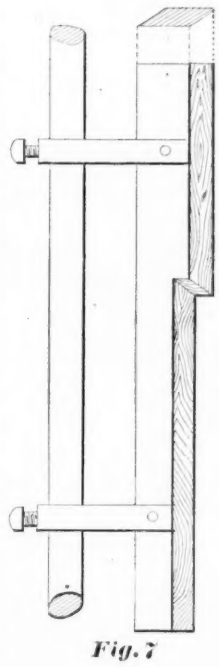


Fig. 7

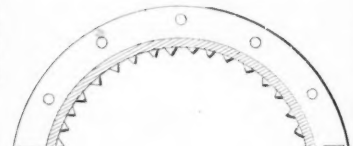


Fig. 3

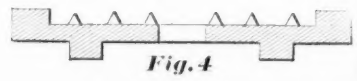


Fig. 4

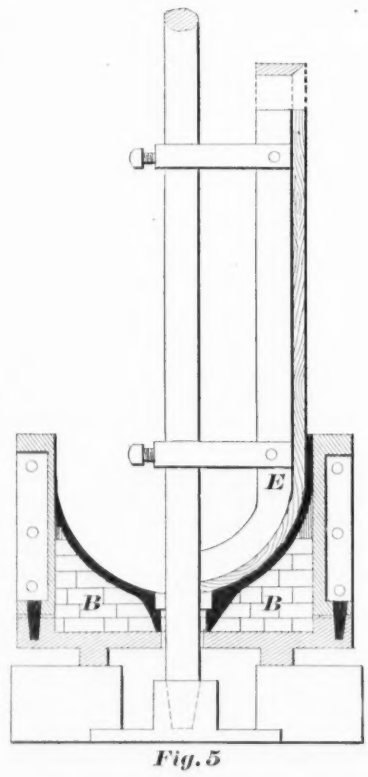


Fig. 5

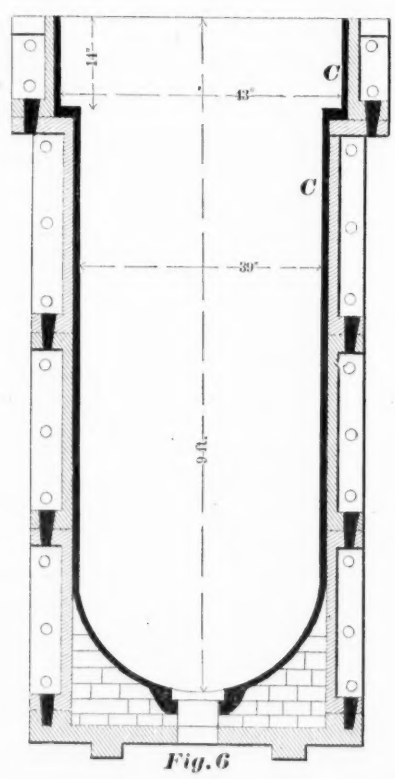


Fig. 6

The Pioneer Locomotive Engineer.

At the recent convention of the Brotherhood of Locomotive Engineers at San Francisco, David Matthews, the pioneer locomotive engineeer of America, was an honored guest of the fraternity although he is no longer engaged in railroad occupation. Mr. Matthews though still hale and hearty, in full possession of all his physical and mental faculties, took a leading hand in early railroad mechanical operations among a generation of engineers that has long passed into history. He helped to build the locomotive DeWitt Clinton, which was the first engine that did work on a railroad in New York State; he put the machine together and ran her during the first trip from Albany to Schenectady on July 5th, 1831. The engine was built at the West Point foundry, N. Y., and was made from the designs of John B. Jarvis, chief engineer of the Mohawk and Hudson Railroad, which was the first link of the New York Central Railroad. Mr. Matthews was afterwards master mechanic of this road, and he invented many of the devices that have become ordinary features of all locomotives.

New Twombly Locomotives.

Mr. Twombly, general master mechanic of the Chicago, Rock Island, and Pacific Railway, is building ten new locomotives in his shops at Chicago, from his own designs. Six of the engines are moguls, intended for the heavy freight service of the Southwestern divisions and the other four are designed for fast passenger service. The boilers for all the engines are of the same size, and their construction indicates that the designer believes in ample steam room and heating surface. The boilers are straight and have a diameter of 54 inches. The fire-box is 5 feet long, and the tubes are 11 feet 4 inches long, and they number 164. The shell of the boiler is made from Otis steel $\frac{7}{16}$ inch thick, the outside of fire-box is of the same steel ½ inch thick, the flue sheets are ½ inch thick, and the inside fire-box sheets have a thickness of $\frac{5}{16}$ inch. The crown of the fire-box is arched, and is bound to the outer shell by radial stays. The fire-box will be equipped with a jet "smoke-consuming" arrangement, similar to what Mr. Buchanan uses without the water tube.

If the municipal authorities of Chicago have any public spirit or sentiment of patriotism which dislikes the desecration of their fine buildings by a coating of soot, they will confer honors upon Mr. Twombly for grappling, in a practical manner, the work of prevention of smoke. For several years they have been hurling ordinances against smoke at steam users and furnace proprietors, but the smoking goes on as opaquely as ever. Tug boats, locomotives, factories, and private houses, all seem to vie with each other in deepening the dark cloud of smoke that continually enshrouds Chicago, and they are in a fair way of eclipsing Pittsburgh, as the premium city of smoke. The presence of a locomotive that prevents smoke will be better than scores of missionaries telling that heavy volumes of smoke are not a necessary feature in the combustion of bituminous coal.

LETTERS FROM PRACTICAL MEN.

The Point of Cut-off in a Locomotive Engine.

Editor American Machinist:

In the AMERICAN MACHINIST of October 11, Mr. State asks for a diagram of locomotive valve motion, the valve having 5″ travel, $\frac{1}{16}$″ lead, and 1″ lap, and wishes to know at how many hundredths of the stroke cut-off will take place.

If the link is in such position that the valve will have the same motion as if worked by a single eccentric, then the average cut-off would take place at eighty-two or eighty-three one-hundredths of the stroke.

He also asks for the point of cut-off with the same valve, 2⅝″ travel and $\frac{5}{16}$″ lead, which would, if the valve had the same motion as if driven with a single eccentric, make the cut-off average at thirty or thirty-one one-hundredths of the stroke. But in the above there will be noticed a good many "if's," and this is an excellent example of theorizing about a thing and leaving out some of the important factors. As has before been shown, the length of the connecting and eccentric rods are disturbing elements, and in the case of the link motion the position of rocker arm, point of attachment, etc., further modify the results; besides the undeterminable conditions, such as spring of parts, lost motion in the joints, etc., are likely to upset things, so that unless these disturbing features neutralize each other, the results are not at all likely to agree with the theory.

With a knowledge of all the conditions, it is not a very complicated problem to determine by the diagram, fairly correctly, what the results ought to be, but it is very difficult to describe in such a way that one can learn from the description.

There are reasons why it is desirable to have a perfectly uniform cut-off at each end of both cylinders in a locomotive, regardless of economical considerations. The least change in the valve action from slipped eccentric or other causes would the sooner be detected by the engineer; but I have heard of but two engines where the cut-off was equal with the link in various positions and in both forward and backward motion. Whether this result was obtained at the sacrifice of proper lead is more than I know.

Probably not. It is not safe to say that this cannot be done, as there are so many things that can be done to-day that could not be done yesterday, that none of us know what may be done to-morrow. JOHN E. SWEET.

Safety Switches and Safety Elevators.

Editor American Machinist:

I think our old friend, J. W. See, in his article on "Safety," is in error in locating the "ground switch" between the distant and home signals. In all interlocking switch systems I have seen, the ground switch is the final resort, and is placed between the home signal and the point the train should not pass; in other words, the train must have passed two danger signals before being "ditched."

His reference to elevator ropes is timely, and the danger of a double strain being thrown on a worn-out rope is an ever present one. It used to be the practice of Otis Tuffts, one of the pioneer elevator builders, to put four, and sometimes six, ropes on his passenger elevators, and at the end of the first, and every year after, to renew one of the ropes, making their life four or six years, and having the security of one new one all the time.

P. H. BULLOCK.

Warnerville, Mass.

Cutting Down the Face of Gear Wheels in the Mould.

Editor American Machinist:

In your issue of October 25th, is an article on the above, by Mr. Masters. As to his being a simple method I have no doubt, but I have doubts as to its being a quick way. I have cut down a good many gears in different ways, and the best and safest plan, I think, is to start at the bottom instead of at the top. My plan is to bed-in your pattern or roll over, as the case may be; only in ramming up the arms and center it is not necessary to riddle your sand the first time. You can shovel it in, and the harder you ram it the better, so as to get a hard parting. Of course you ram the teeth the way you want them, as you do not have to disturb them. Ram up cope as usual. After lifting cope off dig out sand from arms and hub, pull your pattern up as much as you want it made narrower on face, then take your facing sand and tuck under your teeth from the inside, also hub and arm. All the sweep you need is to strike off the arm cores to proper depth. I think this is the better plan, as you don't need to disturb the tops of your teeth. When you cut it off the top it generally "fins" more or less. I think I can make gears quicker and better the way I describe than I can by Mr. Masters' plan.

Wausau, Wis. GEO. O. VAIR,
Foreman moulder of D. J. Murray Mfg. Co.

Webb's Compound Locomotives.

Editor American Machinist:

The foot-note which you appended to "Lead's" courteous notice of my letter relating to compound locomotives is a sufficient explanation of all that may therein appear contradictory to him; but as there are points which he advances as possible objections to the system, and which are independent of his misconception of my location, I will explain as far as I can and as briefly as possible. My opportunities for observing the performance of the engines in question extended over a period of about five weeks, and during that time I certainly did not see an engineer or fireman riding on the tender, neither did they advance to me any remark that suggested unsteadiness in running, but on the other hand they seemed to be perfectly satisfied with the machine, which to me seemed much above the average in that particular. As to starting a train with the low-pressure piston and one high-pressure piston on the dead center, it would only be necessary to slip the back drivers, which can be done as easily with a thirteen-inch cylinder as both pairs of drivers on a coupled engine could be slipped by a cylinder eighteen inches in diameter.

Concerning repairs, I can only say that the first engine built of this type was in the shop for inspection and repairs at the time of my visit, and the amount of wear was so small, considering the mileage made, that it was a source of surprise to me.

In conclusion I may say that this communication and the former one were prompted solely by a desire that the truth may prevail.

J. T. M.

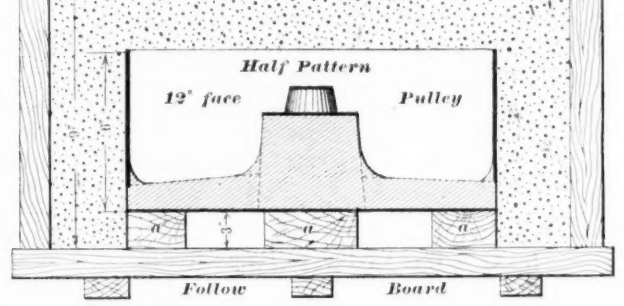
Making an 18-Inch Face Pulley from a 12-Inch Pattern.

Editor American Machinist:

Mr. Masters, in a recent issue of the AMERICAN MACHINIST, illustrates very clearly one way of making a gear wheel of less face than the pattern. To make one with more face is equally as easily done.

A pulley was wanted 20″ diameter, 18″ face. The pattern was in halves, arms and hub attached to each half of rim, and only 12″ face. How to make a pulley with 18″ face and have the hub and arms in the center was the question. Punching the amount needed with a circular piece of wood, as is sometimes done, was out of the question with 3″ on each side to punch. To build on to the pattern, carrying out the draft, was equally impracticable, as it would terminate in a knife-edge.

How the job was accomplished will be understood by referring to the sketch, which represents the drag with the half-pattern in place. Blocks of wood, *a*, 3″ thick, were got out by the carpenter, with dowel-pins and holes to correspond with those on the pattern. These blocks, three in number,

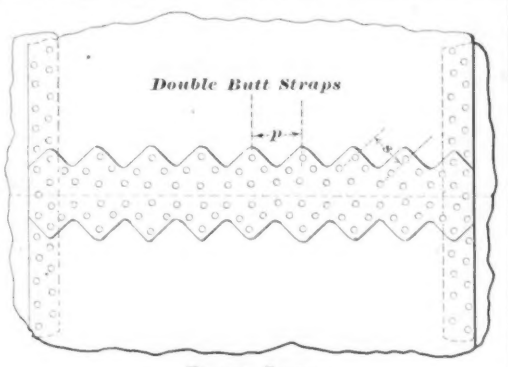


were placed under the pattern and the drag rammed up. When turned over the pattern was, of course, 3″ below the joint. The pattern was then drawn up even with the joint, this part finished up firm, blocks replaced and top half of pattern put on, the dowel-pins in holes in 3″ block. This brought the half-pattern in cope 3″ inside the joint. After ramming up and lifting off cope the pattern was drawn up to joint, sand tucked in around hub and arms, and joint made firm, true with flask joint, and sand secured with spikes. This made the pulley face 6″ wider than pattern, hub and arms in center and size of arms same as pattern.

If it is required to have the hub longer than the hub of pattern, in the space gained by drawing 3″ on a side sand can be put in and a hub bedded-in, making the length desired; or the hub can be cast the 3″ on a side longer than pattern, and if too long it can be cut off in the machine shop.

L. C. JEWETT.

A party in New York recently recovered heavy damages from the Elevated Railroad Company for pain caused by a spark from a locomotive getting into his eye. The jury held that the company did not use the best means for arresting sparks, consequently they were liable. A jury of men who do not know anything about mechanical appliances are readily deceived by the sophistry of lawyers in a suit of this kind, but we feel certain had the jury understood anything about spark-arresters they would have decided that the company spared neither labor, trouble nor expense to prevent the throwing of cinders and dust from their engines. The spark-arresting appliances they use are as nearly perfect as anything can be made for this purpose. The verdict merely expressed prejudice against the company, not condemnation of carelessness in the operation of the road.



BOILER JOINT.

Thom's Improved Boiler Joint.

We reproduce from *Engineering* the engraving and description of this joint:

"We illustrate below new form of boiler joint invented by Mr. John Thom, of 8 Storey Square, Barrow-in-Furness. The engraving shows the arrangement so clearly that very few words of explanation will suffice. The lines of rivets form zig-zags or vandykes, and the edges of the covering strip are cut to a corresponding contour in order that they may not spring away from the plate when caulked. This disposition of the rivets permits of the minimum of reduction of the cross-section of the plate, the number of rivet holes in the outer row, where the plate encounters the maximum strain, being only one-half of that of the inner rows. The joint has a strength equal to about ninety per cent. of that of the solid plate, and by its use a saving of fifteen per cent. of the weight of plates can be obtained with equal strength. It has been passed by the Board of Trade for some boilers now building. The following are the formulæ by which the strength is computed:

Let t = Thickness of plate,
S = Pitch diagonally,
p = Pitch of rivets (greatest),
d = Diameter of rivets,
a = Sectional area (one rivet),
n = Number of rivets in $p = 5$,
1.75 = For rivets in double shear,
$\frac{28}{28}$ = For steel plates and steel rivets.

Percentage of plate to solid plate =

$$\frac{p-d}{p} \times 100.$$

Percentage of rivets to solid plate =

$$\frac{n \times a \times 1.75}{p \times t} \times 100 \, \tfrac{28}{28}$$

$$S = \tfrac{6}{10} p + \tfrac{4}{10} d + d.$$

Lap joints can be made in a similar manner."

F. B. Allen, general supervising inspector of the Hartford Steam Boiler Inspection and Insurance Company, has taken a trip on business connected with that company to the Pacific coast. Mr. Allen is a gentleman whom, from long acquaintance, we can commend, both as a well-qualified engineer and a reliable man of business. We believe it is the intention of the Boiler Insurance Company to establish an agency on the Pacific coast. In this section of the country they have many thousands of boilers insured under their supervision, and we never have heard of any insured party being dissatisfied with the service rendered. They do something more than insure boilers for their patrons. Careful periodical inspections are made, water and scale analyzed, and considerable steam engineering advice furnished free to those who insure. The extra information furnished, upon special enquiries, is often worth much more than the amount paid for premiums.

The Gain in Heating Feed Water.

From the advance sheets of a pamphlet by the Bridgeport Boiler Works, describing the peculiarities and advantages of the Lowe feed-water heater and purifier, we extract the following as of general interest:

"The result of the consideration of the saving of fuel by applying a good feed-water heater is astonishing. Assuming that boilers are required to furnish 100 horse-power for ten hours per day for their reasonable life, say fifteen years, and that four pounds of coal is required per horse-power per hour, and we assume 300 working days per year, which will be 4,500 days for the fifteen years, and 100 horse-power at four pounds per hour is 4,000 pounds of coal per day of ten hours, and 18,000,000 pounds for the fifteen years; which at one-quarter cent per pound is $45,000.

"Now, suppose we can save a paltry five per cent. of this (there are many who would not consider this worth looking after), and we get $2,250, enough to buy nearly 200 horse-power of boilers; then call it 500 or 1,000 horse-power, and the saving would be $11,250 and $22,500, enough in the latter case to buy fuel enough for fifty horse-power for fifteen years. The amount of fuel that can be saved by heating the feed-water by the exhaust steam is shown by the fact that one pound of water must be converted into steam to heat five and one-half pounds from 32° up to 212°.

"Therefore, 100 horse-power, at thirty pounds of water evaporated per hour per horse-power, would be 3,000 pounds per hour, and 30,000 pounds for ten hours; and to raise this water from 32° to 212° will require one pound addition for every five and one-half pounds, and we get 5,545 pounds of water to be evaporated in excess of what would be needed for 100 horse-power, if the water was heated up to 212° by the exhaust steam from the engine, and if the boilers would evaporate seven pounds of water from 32° under seventy pounds' pressure to the pound of coal, we should have to evaporate without the heater 35,545 pounds of water; and this divided by 7 gives 5,077 pounds of coal required in this case, and with the heater 30,000 pounds of water to be evaporated; this, divided by 7, gives 4,285 pounds of coal—a saving of 792 pounds of coal for 100 horse-power, ten hours—about fifteen per cent.; which is not quite accurate for these conditions, but very near it, and is the simplest way to show to all the advantages of heating feed-water by the exhaust steam from the engine. This should awaken those who are pumping cold water into their boilers, or heating it by steam taken directly from the boilers, to the advantage and saving of fuel by using a good feed-water heater. * * * *

"In the foregoing history of feed-water heaters it is shown what the saving in fuel is by heating feed water by exhaust steam; to this must be added the saving obtained by purifying the water. This saving is found in the economy of fuel due to clean boilers, and in the least cost for repairs and stoppages caused thereby; also in prolonging the life of the boiler to its utmost endurance. The saving from all these sources may amount to several times the cost of the boilers during their life."

The locomotive fitted with the Strong valve gear which we recently noted as being in the shop for repairs, was broken up by a collision at a crossing over a switch, caused by a blunder of the switchman. The two engines were thrown together sideways, so as to break both. The engine is being built over, without any alteration.

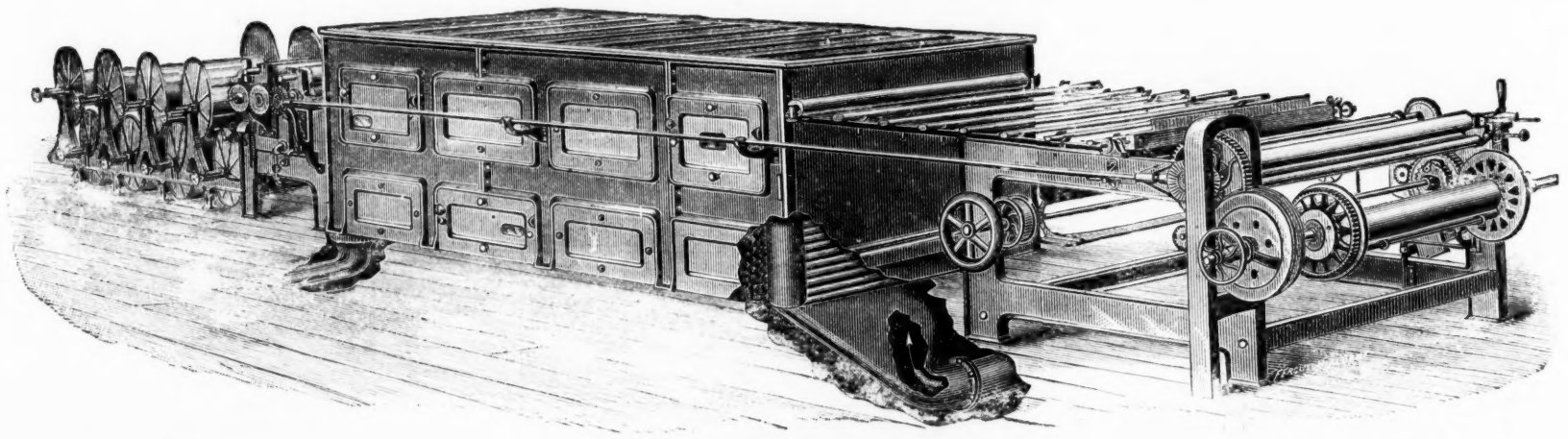
Becker's Hot-Air-Drying Sizing Machine.

In this machine the Howard & Bullough head and size-box are used, between which placed the Becker drying chamber. This chamber—in height four feet and from ten to twenty feet in length—is enclosed by an air-tight casing, and is divided into horizontal sections by galvanized iron plates, the sections being open at alternate ends.

In one end a steam heater is placed, of a capacity for heating 3,000 cubic feet of air per minute to a temperature of 200°. The air is forced into and through the several divisions of the chamber, and the yarn is similarly caused to make the circuit of the several chambers, from the size box, by means of suitably arranged rollers. After leaving the last roller it is wound upon the weaver's beam ready for use. The air after making the circuit of the several divisions or apartments of the chamber, and taking up the moisture of the yarn, is discharged at the bottom, just below the point at which the yarn enters.

It is claimed for this machine that it is less complicated and more durable than other machines for the same purpose, that it does more and better work, and that it does not sensibly increase the temperature of the room in which it is situated.

These machines are made by the Cohoes Iron Foundry and Machine Company, Cohoes, N. Y.



BECKER'S HOT-AIR-DRYING SIZING MACHINE.

Theory of the Steam Engine.

In his paper on the above subject, read before the British Association at Montreal, Prof. Thurston devotes considerable attention to tracing the growth of the thermo-dynamic theory of the steam engine. To James Watt he attributes the original discovery of the limitations of the thermo-dynamic theory of heat engines, and its application in the design and operation of such engines. This line of investigation was followed out in Europe by many eminent engineers, and in this country Isherwood, Emery and others helped to elucidate the subject. The limitations are due to the fact that losses occur in the operation of steam engines which are not taken into account by the hitherto accepted theories of the engine, and have no place in the thermo-dynamic treatment of the case.

It is usually assumed, in the usual theory of the steam engine, that the expansion of the working fluid takes place in a cylinder having walls impermeable to heat, and in which no losses by conduction or radiation or by leakage can occur. Of these losses which actually take place in the real engine, that due to leakage may be prevented: or, if occurring, can be checked; but it is impossible, so far as now known, to secure a cylinder of perfectly non-conducting material. The consequence is that, since the steam or other working fluid enters at a high temperature, the surfaces of cylinder, cylinder-heads and piston are at one instant charged with heat of high temperature and at the next moment exposed to lower temperatures, and are drained of their surplus heat, which heat is then rejected from the cylinder and wasted. Thus, at each stroke, the metal surfaces, exposed to the action of the expanding substance, alternately absorb heat from it, and surrender that heat to the "exhaust." In the case of gas engines, this waste is rendered enormously greater by the action of the water-jacket which is there needed to keep the cylinder down to a safe temperature, and which takes away, in the circulating stream of cooling water, an immense amount—usually about one-half—of the heat received from the burning gas. In the steam engine, the loss by the method here referred to is rarely less than one-fourth in unjacketed cylinders, and is often more than equal to the whole quantity of heat transformed into mechanical energy. The amount of this loss increases with wet steam, and is diminished by any expedient, as steam-jacketing or superheating, which prevents the introduction or the production of moisture in the midst of the mass of steam in the cylinder. As the range of temperature worked through in the engine increases, as the quantity of steam worked per stroke diminishes, and as the time allowed for transfer of heat to and from the sides and ends of the cylinder and the piston is increased, the magnitude of this loss increases. Hence the use of high steam, of a high ratio of expansion, and of low piston speed, tends to increase the amount of this waste, while low steam, a low ratio of expansion and high engine speed, tend to diminish it. These physical phenomena are, therefore, no less important in their influence upon the behavior of the engine, and upon its efficiency, and are no less essential elements for consideration in the general theory of the engine than those taken into account in the purely thermo-dynamic theory.

While experimenting with the little model of the Newcomen engine at the University of Glasgow, Watt discovered that the cylinder required four times its own volume of steam, thus wasting three-fourths of the supply. Further investigation demonstrated that cylinder condensation was the cause of this waste of heat. This phenomenon of cylinder condensation became quite familiar to the contemporaries and successors of Watt; yet it is a curious fact, and one of great interest as illustrating the gulf formerly separating the philosopher studying the steam engine and working out its theory from the practitioner engaged in its construction and operation, in the earlier days of engineering, that, notwithstanding the fact that this waste was familiar to all intelligent engineers, from the time of the invention of the modern steam engine, and was recorded in all treatises on engine construction and management, the writers on the theory of the machine have apparently never been aware that it gave rise to the production in the working cylinder of a large amount of water mingled with the steam. When this water was perceived its presence was generally attributed to priming at the boiler, and even Rankine attributed the presence of water in the steam cylinder to the condensation of dry steam while doing work.

Prof. Thurston notices the discoveries and theories of the various engineers and scientists who labored to elucidate the subject of cylinder condensation with its relation to expansion, and credits D. K. Clark with being the first to discuss this subject with knowledge and with a clear understanding of the effects of condensation in the cylinder of the steam engine upon its maximum efficiency. After a long and arduous series of trials of locomotive engines, and prolonged experiments to measure the magnitude of waste produced, Clark asserted that the magnitude of the loss is so great as to defeat all attempts at economy of fuel and steam by expansive working, and it affords a sufficient explanation of the fact, in engineering practice, that expansive working has been found to be expensive working, and that in many cases an absolutely greater quantity of fuel has been consumed in extended expansion working, while less power has been developed. He states that high speed reduces the loss, but to prevent entirely the loss from condensation of steam worked expansively the cylinder must be maintained by independent external means at the initial temperature of the steam.

Mr. B. F. Isherwood, a Chief Engineer in the United States Navy, and later Chief of the Bureau of Steam Engineering, seems to have been the first to have attempted to determine, by systematic experiment, the law of variation of the amount of cylinder condensation with variation of the ratio of expansion in unjacketed cylinders. Experimenting on board the U. S. S. Michigan, he found that the consumption of fuel and of steam was greater when the expansion was carried beyond about one-half stroke than when restricted to lower ratios. He determined the quantity of steam used, and the amount condensed, at expansion ranging from full stroke to a cut-off at one-tenth. His results permit the determination of the method of variation with practically satisfactory accuracy, for the engine upon which the investigation was made, and for others of its class. It was the first of a number of such investigations made by the same hand, and these to-day constitute the principal part of our data in this direction. The writer, studying these results, found that the cylinder condensation varied sensibly as the square root of the ratio of expansion, and this is apparently true for other forms and proportions of engine. The amount of such condensation usually lies between one-tenth and one-fifth the square root of that ratio, if estimated as a fraction of the quantity of steam demanded by a similar engine having a non-conducting cylinder.

The theory of the steam engine stands to-day incomplete, but on the verge of completion, needing only a little well-directed experimental work to supply the doubtful elements. Even these are becoming determined. Isherwood gives facts showing waste to be proportional, very nearly, if not exactly, to the square root of the ratio of expansion, and Escher, of Zurich, has shown the loss to be also proportional to the square root of the time of the exposure, or, in other words, to the reciprocal of the square root of the speed of rotation, and it only remains to determine the method of variation of loss with variation of range of temperature to give the whole of the necessary material for the construction of a working theory which will enable the engineer to estimate, in advance of construction, the economic performance of his machine. There will, undoubtedly, be much more to be done in constructing an exact theory involving all the physical changes occurring in the working of the heat engines familiar to us; but it will yet be done, and probably very soon. The hope is expressed by Prof. Thurston that experiments made under his direction, recently, may furnish the needed data, as the result of the first systematic research directed to that end; but if this should not prove to be the fact, it cannot be long before direct investigation will secure all essential knowledge.

There is an English publication called *Invention*, which has a most misleading title. The paper is meant to be of a mechanical nature, and we think the publishers would express the characteristics of their journal better if they would call it *Steel*. In one recent issue we observed six articles filched from the pages of the AMERICAN MACHINIST without credit. When the thefts from all other journals are summed up, we think there would be a very small share left as representing the inventive faculties of the editors.

The editor of the *Journal of Railway Appliances* contests the expressed opinion of practical correspondents that a spring latch, to be operated by the fireman's foot, is an abomination. He does not see that the fireman's foot would have to work faster on an engine running sixty miles an hour than it would have to move on an engine making forty miles an hour. Some of us who have been there, find very good reason why the fireman of a high-speed locomotive should have no other use for his feet while firing than to perform the difficult feat of preventing his body from assuming a horizontal position on the deck.

Does Incrustation in Boilers Retard Evaporation?

In a paper read before the American Association for the Advancement of Science, several years ago, on boiler incrustation, Dr. J. D. Rogers said: "The evil effects of scale are due to the fact that it is relatively a non-conductor of heat. Its conducting power, compared to that of iron, is as 1 to $\frac{37}{50}$. This known, it is readily appreciated that more fuel is required to heat water through scale and iron than through iron alone. It has been demonstrated that a scale 1-16th of an inch thick requires the extra expenditure of 15 per cent of fuel. As the scale thickens, the ratio increases. Thus, when it is $\frac{1}{4}$ inch thick, 60 per cent. more is required."

Dr. Rogers does not tell where or by whom the demonstration was given that a scale $\frac{1}{16}$ inch thick increased the fuel expenditure 15 per cent., but he assumes the demonstration to be correct, and, following out a line of reasoning based on what has turned out to be an error, he proceeded to demonstrate to his own satisfaction, and that of the American Association for the Advancement of Science, that boiler scale may accumulate in thickness till consumption of fuel will result in no steam-making. Few papers that have been read before scientific societies have contained more inaccuracies than that referred to, yet for years the statements made by Dr. Rogers have been accepted as true throughout the whole of this country. When he wrote about the increased expense of steam-making due to the

presence of incrustation, Dr. Rogers had attentive readers among steam users, who readily accepted as truth assertions that were advanced in a plausible manner by a scientist in a scientific meeting, and students of steam engineering accepted the data so authoritatively presented without question. Many practical men of observing habits in charge of steam boilers perceived the fallacy of Dr. Rogers' conclusions, but they were seldom in a position to make their views public, and the American engineering world continued to believe that $\frac{1}{16}$ inch of scale seriously decreased the evaporative capabilities of a boiler.

Murmurs against the prevailing belief in the obstructing effect of scale on the transmission of heat were occasionally heard, but they took no decided form until the publication was made of the result of accurate tests conducted at Munich, in Bavaria, last year, to ascertain the relative evaporative value of fuel in a perfectly clean boiler and in one badly coated with incrustation. The tests were very carefully conducted by experts accustomed to the business. By using water saturated with sulphate of lime, a scale exceeding $\frac{1}{4}$ inch was soon put upon the heating surfaces of the boiler, but even with that thick crust the evaporation of water was not materially decreased from what was effected with clean sheets. Since the result of these tests was made public, many of our engineers and boiler users have furnished facts regarding cases of badly scaled boilers that go to prove that incrustation has very little effect in reducing evaporation, although its presence may be extremely injurious to the heating surface. In the meantime, there is urgent necessity in this country, where scale-covered boilers are numerous, for careful tests to be made with boilers to show from experiment to what extent a coating of lime interferes with evaporation. Dr. Rogers evidently arrived at his conclusions by a system of philosophical deduction, which, starting from false premises, led the way to multiplying error. We now want some scientist to prove by the records of carefully-conducted tests what the effects of scale actually are—information the mechanical world is still waiting for.

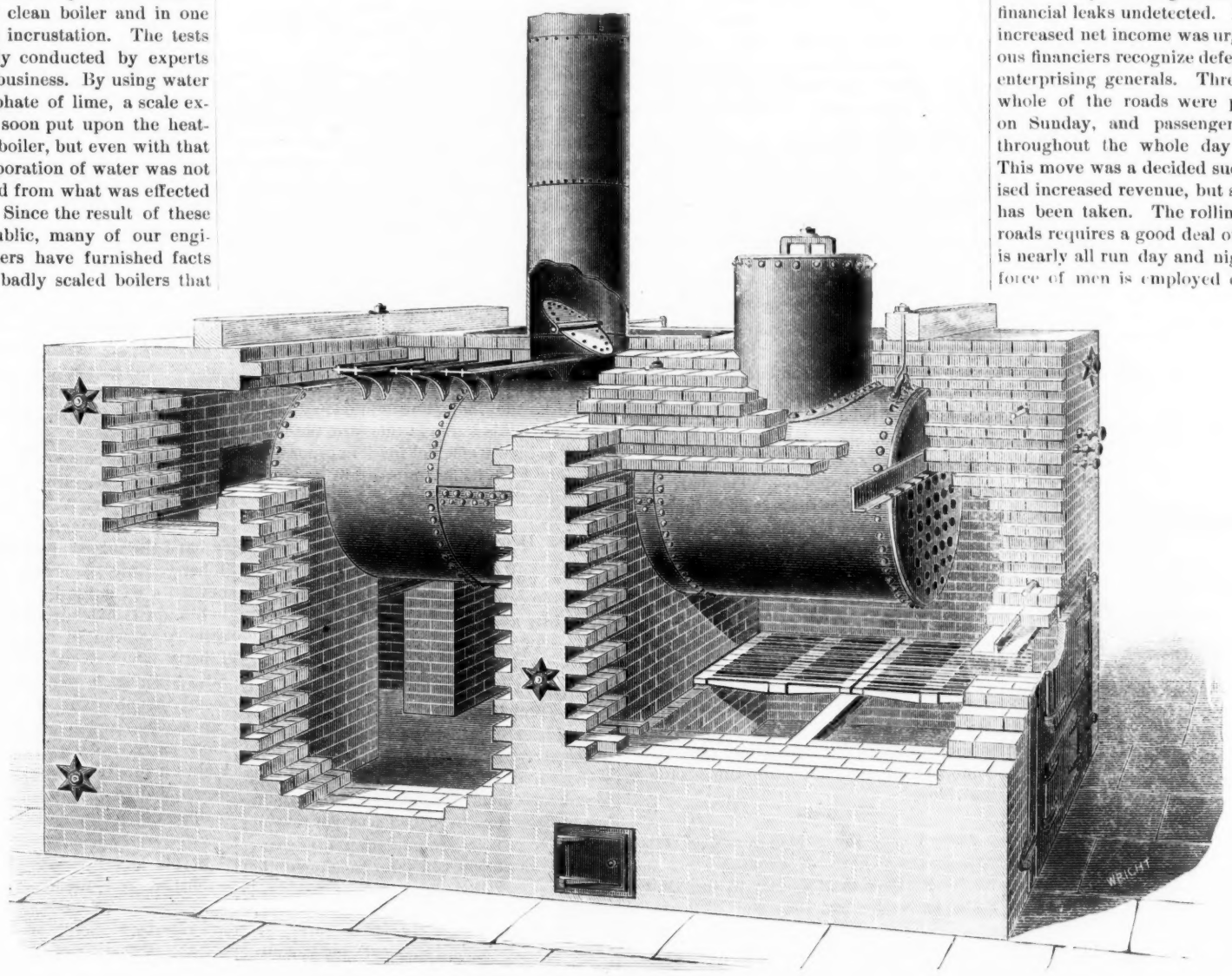
The Pittsburgh Locomotive Works are building a small reversible engine for mining and well-drilling purposes which can be reversed by an operator sixty or one hundred feet away from the engine. The engine has a link motion which is unbalanced, and the link is made with a ring on the top to which a rope is attached. This rope is led over pulleys to the spot where the drill is at work and reversal of the engine is promptly effected by pulling up the link. The engine is simple in construction, the working parts are very strong and every detail is made interchangeable.

Setting for Horizontal Boilers.

The boiler setting represented in the engraving is that of Liddell & Co., Charlotte, N. C. It is peculiar in this respect: The furnace is entirely separated from the rear of the boiler by a wall built close against the boiler, and the products of combustion pass directly forward from the furnace and enter the flues at once at the front end of the boiler. After passing through the tubes they return under the boiler to the rear of the close wall spoken of, and then around the sides of the boiler to the stack, which is set about the center of the setting. Space is left between the brick covering and the back end of the boiler to make a passage-way for the products of combustion to the stack. The brick work above the boiler at this space is supported by special casting, resting on the boiler, as shown in the engraving. The firing door may be at one end, or at the side of the furnace, in case of setting a single boiler.

It is claimed for this setting that the two drafts—from front and rear of furnace—bring about more perfect combustion, and hence greater economy, and makes it practicable to use a poorer quality of fuel; also that the circulation of the water is improved, and less heat lost from radiation than in ordinary forms of setting.

The engraving represents the setting applied to a boiler made by the firm mentioned, but it is applicable to any ordinarily-constructed tubular boiler.



SETTING FOR HORIZONTAL BOILERS.

A. B. Ropes, of Brainard, Minn., a former graduate of the Stevens Institute, gave us a call one day last week. He is employed in the N. P. R. R. shops at that place, and will soon start a night school for 45 of their apprentices. Two evenings a week will be devoted to the school. The boys furnish the instruments and fit up the school room, which has been provided by the company at an expense of several hundred dollars.

The Mechanical Engineers' Meeting.

The first session of the annual meeting of the American Society of Mechanical Engineers will be held in the hall of the Academy of Medicine, 12 West Thirty-first Street, New York, at 8 P. M., on Wednesday, November 5 The secretary, F. R. Hutton, has issued a circular to the members, from which we make the following extract:

"SECOND DAY, THURSDAY, NOVEMBER 6.

"10 A. M.—Hall of the Academy of Medicine. Executive session. Reports of committees, tellers, and general society business. Professional papers and discussion to follow.

"2 P. M.—Third session, for professional papers and discussion.

"The evening of Thursday has been purposely left unappropriated, and no session will be held. This is done to allow non-resident members to attend the annual fair of the American Institute, and to avail themselves of other professional opportunities. Complimentary tickets have been secured for the Institute Fair by the courtesy of the general superintendent and the board of directors, and these tickets may be had at the secretary's desk. The fair is held at Sixty-third Street and Third Avenue, and the Third Avenue elevated road has a station at the doors.

"THIRD DAY, FRIDAY, NOVEMBER 7.

"An excursion to the City of Paterson, N. J., has been arranged for this day. A special train, furnished by the courtesy of the Delaware, Lackawanna and Western Railroad, will convey the members from their terminal station at Hoboken. Ferries leave foot of Christopher Street (reached by cross-town cars in Eighteenth, Fourteenth, and Eighth Streets) and foot of Barclay Street, North River. The points of interest will include the rolling mill, the Rogers, Grant and Cooke Locomotive Works, and an opportunity will be given to visit a silk mill. Returning in the afternoon, the society are invited to visit the laboratories and workshops of the Stevens Institute of Technology. The institute buildings are but a short walking distance north of the railway station, and will be open to visiting members by the courtesy of the trustees and faculty."

Reducing Expenses on the New York Elevated Railroads.

The parties interested in deriving revenues from the elevated railroads of New York, or in maintaining the market value of the stock of that corporation, seem to be working with infinite industry. Several months ago the financial necessities of Messrs. Gould, Sage, and other directors, demanded that the operating expenses of the elevated railroads should be defrayed from half the gross income. It was, however, an easier matter to order a reduction of expenses than to point out where retrenchment was to be carried out, for the roads were operated in a remarkably economical manner, no superfluous help was employed, and the eagle eye of a most practical general manager left no financial leaks undetected. But the need for increased net income was urgent, and ingenious financiers recognize defeat no more than enterprising generals. Three weeks ago the whole of the roads were put in operation on Sunday, and passengers were carried throughout the whole day for five cents. This move was a decided success and promised increased revenue, but still another step has been taken. The rolling stock on these roads requires a good deal of repairs, since it is nearly all run day and night, and a large force of men is employed doing the work. Though the force is large, no superfluous man is employed, and the number could not well be reduced without breaking up the system. Reduction of pay was impracticable, but the problem has been solved by reducing the hours of labor ten hours per week, and this system of working was begun on October 20. When more trains are running weekly and the work of repairing reduced, it seems that the rolling stock of the elevated railroads will not be very safe to ride in after a few months. But perhaps all that is needed is large income and small expenses for a few weeks to help out stock broking necessities.

The London *Ironmonger* says that Hillman, Herbert & Cooper, of Coventry, have an order for 300 "kangaroo" bicycles from the United States, "where they are to be introduced largely."

Copper plate and tubes can stand the Russian tariff duties no longer. Formerly a well-known German firm used to send very large quantities into Russia, but now the same firm does but very little business in this market. On the other hand, the Russian copper works have been greatly increased.

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☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery, nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draughtsmen and all those especially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once.*

NEW YORK, NOVEMBER 15, 1884.

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Tyrannical Action of a Combination.

Daily newspapers are fond of publishing essays on the unjust and arbitrary decisions of trade unions, and it must be admitted that there are occasions when adverse criticism is needed; but we have seen no editorial in a daily paper condemning the tyrannical proceedings of the Tack Manufacturers' Union. If trade unions of workmen, who never have had experience in managing a business, deserve public censure for trying to coerce employers into granting something demanded, much more does a manufacturers' union of experienced business men deserve public censure for trying to crush independent competitors out of existence.

The daily press some weeks ago spread the news that the tack manufacturers' combination had given the Reading Tack Works the alternative of selling out at the terms offered, or having their business ruined. Forced to the rack, they chose the former and sold out to the combination. Since then the tack factory at Lakeville, Mass., has been closed by the combination, and free competition in tacks seems to have been dealt a stunning blow.

The State of Pennsylvania has conspiracy laws of some kind which seem to apply to workmen who form unions and strike to accomplish certain objects. We should like to have somebody explain why the conspiracy laws do not apply to the action of the tack combination in threatening to destroy the business of the Reading works unless the alternative was accepted? If anything is a conspiracy to ruin a private business, we certainly contend that the action of the combination was a conspiracy, and should have been dealt with according to law. No State has a right to enact laws that bind workers for wages and exempt others from like specific offences. The daily press has failed to present these facts in their true light, probably fearing a loss of patronage if the combination should be offended.

Both workmen and manufacturers have the right to form unions and associations for mutual benefit. Where the action of these associations does not infringe upon the rights of others, no just censure can be aimed at them. The tyrannical course of one association should not be pointed out as condemnatory of another that has never resorted to such methods. In this respect unions and combinations stand upon the same plane as individuals.

According to the British Board of Trade returns the exports of steam engines and machinery from that country to the United States for September, 1884, were of the value of £25,971, against £27,375 for September, 1883. The pig iron exports to this country were 20,819 tons in September, 1883, and 15,094 tons in same month of 1884. The steel rail exports to the United States have become *nil*.

Variety in Designs.

One of the most curious phases of human nature sometimes reveals itself in those who design or construct machinery, in the length to which a man will go, apparently driving himself, in making a thing unlike some competitor's design. This is sometimes done, to be sure, for the very good reason that there may be found two or more equally good, though widely differing, ways of doing the same thing, but differences are sometimes known to exist which have neither right nor reason between them. It can be truly said of many engineering contrivances, or expedients, that they have grown and been perfected by the general and concurrent effort of many painstaking men, and hence they are open to all the world, no one asking or expecting an account to be rendered for their use. It is quite another thing to adopt, and to seek to gloss over with secondary and sometimes useless detail and ornamentation, a special, well-recognized feature of engine or machine-tool construction, as if the eyes of veterans in the art of such design would not sooner or later show up the exact bottom fact to purchasers, who are apt to understand such details of the goods they expect to buy when pointed out. Honesty in design has its value, as well as accuracy in the construction of the device when its outline has been fixed upon, and to refrain from copying, or to do a thing notoriously unlike another, may prove as dangerous, or as certain to be commented upon unfavorably, as the exact but unwarranted adoption of another's design.

Eugene Bourdon.

Mr. Eugene Bourdon, inventor of the well-known pressure gauge died recently in France, at the age of 77 years, from the results of an accident met with while making experiments with an anemometer on the Orleans Railway. Mr. Bourdon was a prolific inventor, but the pressure gauge is his best-known production, and he realized a fortune from its manufacture. This invention filled a badly-needed want in steam engineering, and the mechanical world readily acknowledged its merit.

Most of our readers are probably aware that the principle of the Bourdon pressure gauge was based on the discovery that steam admitted into a closed curved tube tended to straighten it out. About the year 1849 Bourdon put this tendency to practical use, by constructing a gauge with mechanism that was moved by the movement made by a curved tube towards a straight line. When the invention was perfected it consisted of a brass or steel tube of elliptical cross section. One end of this tube was rigidly fastened to that part of the instrument which communicated with the steam pipe, while the other end was free to be moved by the steam pressure, the indicating appliances being attached to this end. In this form the invention was highly efficient for its purpose, and no other form of steam-pressure gauge has approached it in accuracy and durability.

Defective Safety Valves.

In the published accounts of boiler explosions, the cause, "defective safety valve" is frequently assigned. As the safety valve in the case of the general "letting go" of the parts of a boiler, is quite apt to be found in a condition unfavorable to inspection, it is beyond probability that many explosions attributed to other causes might, if the evidence were not lacking, be traced to the safety valve. That is, if the safety valve was found intact, and submitted to an absolute test to determine to just what extent it would operate to prevent accumulation of pressure, it would doubtless often be concluded that the pressure under which a boiler failed was greater than supposed.

A great many so-called safety valves are, from natural causes, chronically defective through excessive friction of parts. Rough pins or bolts in rougher holes, subjected to heat that dries up oil, if any is used, with the dust and dirt to which they are exposed, make the co-efficient of friction enormously high. Add to this the fact that the bearing points are so situated that, as the valve begins to blow, it tilts instead of lifting from its seat, thus creating additional friction on the wings or stem, perhaps crowding the lever hard over against a rough guide, and we have the working condition of a good many safety valves. This condition accounts for the necessity of increasing the pressure 25 per cent. before the valve lifts to the extent of producing actual motion on the parts in frictional contact after it has given notice of blowing by passing a little steam by one side of its seat; also, why a still further increase of pressure is required to lift the valve to the extent that it is popularly supposed to lift, or that it must lift to check accumulation of pressure under certain circumstances. Given a valve working in this way, and it may be all right for years, giving warning to the fireman to regulate his draft to check the rising pressure, and then in the case of emergency the warning may pass unheeded some day, an explosion occur, and the accident be attributed to bad bracing that would have held if the safety valve had worked as it should have done, or to some other convenient cause.

If entire dependence is placed on a single lever safety valve (which is not to be recommended), it should be tested as to its capacity to free the boiler, and no reliance placed upon the theory that a valve of given area will pass a definite quantity of steam. The steam that will be passed by any safety valve depends more upon its construction than upon its diameter, and unless it can be demonstrated by actual trial that, by hard firing the pressure cannot be dangerously increased, the valve is anything but a safety valve. Submitted to this test, many would be at once condemned.

We would again direct the attention of master mechanics to circulars of inquiry issued by investigating committees, and published in another page. The first is on the subject of steel castings for locomotive use—a matter in which the whole association is directly interested. Every member who has had any experience with steel castings ought to send notes thereof to Mr. Bushnell, chairman of the committee. The second subject is hardly less important, being investigating the merits of improvements in locomotive valve gear. The committee seem determined to follow out this line of research with thoroughness, for they call for drawings to illustrate improvements, and indicator diagrams to demonstrate their importance. The subject is being so much agitated at present that valuable information ought to be elicited from master mechanics experimenting with forms of valve gear designed to overcome the weak features of the link motion. Mr. Blackwell, Shenandoah Railroad, Roanoke, Va., is chairman of this committee, and it is to be hoped the members will furnish him with material for making a full report.

The special committee of the Sons of the Revolution of which William O. McDowell is chairman, George W. W. Houghton treasurer, and Austin Huntington secretary, are taking in hand the subscription list to the Statue of Liberty pedestal. President Arthur has headed a $1 subscription list, and a general invitation is extended to everybody in the country to send $1 to the committee, at 55 Liberty street, New York. They wish to raise $125,000 in one-dollar bills. We commend the object of this subscription, and can assure our readers that the well-known high character of the officers of the committee makes it sure that every dollar sent them will be applied to the object for which the subscription is made.

In his letter on compound locomotives, published in another page, A. W. Webb makes use of an expression that sounds odd to American ears. He says the engine "shapes" well. This is a very common English machine shop colloquialism. When machinists there meet, they often pass the compliments of the day by saying, "How are things shaping?" The expression has evidently originated from a vague inquiry about shop operations, and a curious point about it is that the phrase is hardly ever heard except among mechanics or engineers.

Literary Notes.

F. De Berard and T. A. Kennett, who have for some years past conducted the *American Furniture Gazette*, one of the brightest and most interesting trade papers on our exchange list, have determined to widen their field of useful activity by starting, in addition to that publication, a journal devoted to the interests of the hardware, stove, and sheet-metal trades. They propose to call their new venture *The Ironmonger*, and we presume they will aim to inform, instruct and amuse their readers in their new field as in the old one, by gathering trade news and concocting witty "take-offs" and cartoons relating to men and matters connected with the lines of business the new journal aims to represent. Mr. De Berard has long had in mind the establishment of such a journal, and both himself and his associate are exceptionally well qualified for such an undertaking.

The first number of *The Ironmonger* will

appear about January 1st. It will hail from 419 Broadway. New York, and 150 Dearborn Street, Chicago.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(437) G. H., Chicago, Ill.: How is the counterbalancing of locomotive driving wheels accomplished? *A.*—You will find this explained in the AMERICAN MACHINIST of April 12, 1884.

(438) W. P. S., ——, Mich., asks: If I see an article in Canada, can I patent it in the United States? *A.*—To obtain a patent in the United States you must swear that you are the inventor of the device you seek to patent.

(439) W. E., Little Falls, N. Y., asks: Would the Allen slide valve give good results on a stationary engine controlled by governor on main shaft, valve to be balanced? *A.*—The Allen valve, as you describe, is said to give good results on stationary engines.

(440) W. C., Muskegon, Mich., writes: I have seven large boilers under my care, and use crude petroleum to prevent scale. Would it be a good plan to paint the interior and flues of boiler with petroleum when we shut down for the season? *A.*—This is a good plan and one that is considerably practiced.

(441) A. E. M., Providence, R. I., asks: When is the most power required to operate an air pump: when the injection water is on a level with the condenser or when it is lifted? *A.*—With the same vacuum in condenser and using the sameamount of water, we should say there was no difference. The resistance against the motion of the piston in what may be called its suction stroke is the difference between the pressure of the atmosphere and the pressure in the condenser; on the discharge stroke it encounters the resistance of the air, vapor, and water, and is assisted by the pressure of the atmosphere. These conditions will exist without reference to how the condensing water is supplied.

(442) W. R., London, England, asks: Can you or any of your readers tell me authoritatively the correct angles for grinding twist drills supposing the drill to be ground on an ordinary grindstone; that is the angle formed by lip and body of drill, also the angle of the straight lip and the line across point? *A.*—The more common custom is to make the first angle 60°. The second angle named is governed by the shape of the lip and the clearance; features upon which there is not uniformity, and we should not be willing to quote any one as "authority" against another whose practice, though different, may be equally good. It is safe to calculate that the drill as it comes from the manufacturer is ground right, and to be governed thereby in future grinding.

(443) J. S., ——, writes: I am running a pair of 16"x30" automatic engines, 120 revolutions per minute, boiler pressure 45 lbs. It requires to make steam three 60-horse power boilers, burning 7,500 lbs. of coal to run nine hours per day, and bank fires. The superintendent thinks there would be a saving of coal by cutting off one engine, but I think it would require more steam to run one engine than both. Please give me your opinion, and if I am burning too much coal. *A.*—There is a strong probability that there would be a material saving of fuel by carrying 80 or 85 lbs. steam and using only one engine. Before trying this, however, you should have your engines indicated, when you can judge from the diagrams of the probable result of throwing off one engine; or, if not much trouble, try it for a day or two. The amount of coal burned seems rather high for the probable work done, but the conditions appear to be unfavorable for economy.

(444) W. A. W., Indianapolis, Ind., writes: I have occasion to make a large number of steel rolls, 1½"x1½", with a ¾" hole through the center, the rolls to be of medium quality of steel. Can you advise me of the best and most expeditious way of turning these out? Whether to cut them off bar steel or have them cast with a ⅝" core? If cast, what would be the best kind of drill to work out the holes to ¾"? *A.*—Assuming the cost of material to be the same, we do not think there will be much difference in the cost of rolls. It will take about as much longer to turn up the cast-steel roll as the time required to cut off the bar. The bar steel you can drill for the reamer with a single twist drill, while you will require to run two drills through the cored hole, making the time of drilling about the same. A flat drill with lips turned up will cut the steel casting satisfactorily. The above is on the assumption that the rolls are to be turned all over. If not, then we should say make them of bar steel in any event.

(445) C. L. C., Lynn, Mass., asks: 1. In which way will it require the most power to drive our elevator; with the machinery in the basement, near the engine, or in the fourth story, to be belted in both cases from the main shaft? *A.*—We infer that it will be more convenient to belt to the machinery, if in the basement. So far as the power required is concerned, we cannot see that there will be any material difference, although there may be circumstances with which we are unacquainted. On general principles the power required will be the same in one instance as the other. 2. If you are to force water to a height of sixty feet, is it better to have a check valve near the pump? *A.*—The pump check is all that is absolutely necessary. It is very convenient, however, in case it is necessary sometime to look at the pump valves in a hurry, to have a check in the pipe near the pump. We should put one there. 3. Which is the best way to take the power to each story—with a separate belt from the main driving shaft, or have one main belt from that shaft and reduce from that to each story? *A.*—Generally, the plan of one main driving belt is best, but there may be circumstances connected with your building that would call for some modification.

(446) J. H. H., New York, writes: I am running two horizontal tubular boilers 42" diameter by 11 feet between heads; 38 tubes 3" diameter in each, and 12 feet of grate surface. The boilers are used for steam heating, also to run an elevator. In the summer I run the elevator for one floor, using one boiler, and burning one ton of coal per week including coal used for banking fires. It requires the evaporation of 175 gallons of water per day for 26 days per month to run the elevator. In the winter time I run the elevator in connection with the steam heating, and propose not to charge the elevator with coal for banking fires, as they must be banked for steam heating purposes. I think that 1 pound of coal for 1 gallon of water evaporated is as low an estimate as I can allow, and that this should be charged to the elevator. Two friends differ with me. What do you think should be charged against the elevator? *A.*—We think a pound of coal per gallon of water used is about right but that you should charge a *pro rata* amount of the coal used in banking fires to the elevator. That is, if the coal required to operate the elevator is, say, one-eighth the amount of coal burned exclusive of that required to bank fires, then we should say you should charge one-eighth of the coal used for banking fires to elevator.

BUSINESS SPECIALS

Transient Advertisements, 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Curtis pressure regulator and st'm trap. Oct. 25, p.13.

Mackenzie Cupolas and Blowers. 245Broadway, N.Y.

Presses & Dies, Ferracute Mach.Co., Bridgeton, N. J.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

Rotary Files, Tower M.Works, E. Brookfield, Mass.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 86 John street, N. Y.

Friction pulleys and couplings; cheapest and best H. N. Bates, 358 Atlantic avenue, Boston, Mass.

Herbert W. T. Jenner, Mechanical Engineer and Solicitor of Patents, 632 F st., Washington, D. C.

Power Measured—F. Van Winkle, mechanical engineer, 22 Cortlandt street, New York.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Foot Power Machinery, for workshop use, sent on trial if desired. W.F. & John Barnes, Rockford, Ill.

The latest Improved Tack and Match Machinery is made by White Machine Co., Waterbury, Conn.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York

Universal grinders for lathe-centers, chucks, angles, or cylinders. C. C. Hill, 84 Market st., Chicago, Ill

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

The Straight-Line Engine Company, Syracuse, N. Y., will send their new catalogue on application.

National and box chucks, foot and power lathes, and slide rests. Lodge, Barker & Co., Cincinnati, O.

Split Pulleys at low prices, and of same strength and Appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Mech'l drawing and machine designing, work requiring skill and experience solicited. Reasonable rates. Corresp'nce invited. Weston & Smith, Syracuse, N.Y.

DRAWINGS—Mechanical, electrical and Patent Office. All styles of artistic designing. Special facilities. Low rates. Wallace Metcalf, 140 Nassau St., N.Y.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

The "Wax Process" Engravings shown in the AMERICAN MACHINIST each week are made by Struthers, Servoss & Co., 32 Frankfort Street, N. Y.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large: prices low. Frasse & Co., 62 Chatham St., N. Y.

Farley's Reference Directory of the Machinists, Iron, Steel, and Metal-Working trades of the United States. A. C. Farley & Co., Philadelphia, Pa.

Improved Tack Machinery, made by The Willets Man'f'g Co., can be seen in operation at their works, 57 Clifford St., Providence, R. I.

The Complete Practical Machinist, $2 50; the Pattern Maker's Assistant, $2.50; Mechanical Drawing Self-taught, $4 00; books for practical machinists. Address, Joshua Rose, Box 3,306, New York City.

EXTRACTS FROM CHORDAL'S LETTERS, 400 pages, 12mo., handsomely bound in cloth. New and enlarged edition, with over 50 illustrations. Price $2. Published by John Wiley & Sons, 15 Astor place, New York.

MANUFACTURES

M. Kelly has established a machine shop in Durham, N. C.

Oliver Biernes, near Donaldsonville, La., is building a sugar refinery.

The Owensboro Wheel Co., Owensboro, Ky., will enlarge their factory.

The Birmingham Iron Works, Birmingham, Ala., will be greatly enlarged.

The Low Moor Furnace Company, Low Moor, Va., will build another large blast furnace.

The forces at the New York Locomotive Works, at Rome, N. Y., are rapidly being increased.

Fay & Scott, Dexter, Me, have received an order for a lathe and milling machine to go to Cuba.

The Marine Engine Works of Chicago are building Presses for the Toronto *World* and Indianapolis *News*.

The Goss Marine Iron Works, Bath, Me., have been obliged to run evenings a portion of the time recently.

The Lansing (Mich.) Iron Works are erecting a 30x60 brick addition to their building, more room being necessary.

The Mayor and City Council, Waco, Texas, have decided to issue from $150,000 to $200,000 bonds to build gas and water works.

E. Gould & Eberhardt, Newark, N. J., have just shipped an 8-ton forging machine, a cylinder pointing machine, to Western parties.

The Board of Trustees of the South Georgia College of Agricultural and Mechanical Arts, Thomasville, Ga., will erect a $10,000 building.

The Chicago Screw Co. will proceed at once to erect a 90x75 foot addition, five stories high. It is intended to have it ready for use in 90 days.

A company of Union City, Mich., gentlemen propose to start a $100,000 threshing machine manufactory. They want $3,000 in land and buildings as an inducement.

The International and Great Northern Railway shops, at Palestine, Texas, have been shut down. One hundred and thirty hands are thrown out of employment.

The Amoskeag Cotton Mills, at Manchester, N. H., consume sixty to seventy tons coal daily at present. Their daily product is from 200,000 to 225,000 yards, and they are storing no more than is usual at this season.

The 24 inch swing engine lathe made by S. S. Hepworth & Company, Yonkers, N. Y., and illustrated in the AMERICAN MACHINIST last week is of extra weight the 12' 6" bed lathe weighing about 8,000 pounds.

The Standard Foundry Company, of St. Louis, are shipping quite a large number of machine-cast pulley patterns to Sherman, Texas, to be used in the new foundry of the Sherman Manufacturing Company.

Forbes & Curtis, Bridgeport, Conn., report a good business in their cutting-off machines and die-stocks, and have considerably increased their capacity. They are building three "Webster" steam engines on special order.

Chandon, Emery & Company's Foundry at Quincy, Ill., is moving full time and employing 33 men. An addition to this plant, 47x90 feet in extent, increasing its capacity 50 per cent., is being made. The moulding room is 90x100 feet in size.

Nearly all the gins run by water power in the vicinity of Troy, Ala., are crowded with cotton which awaits the rains furnishing the water by which it may be prepared for market. Most of the cotton has been gathered from the fields.

D. H. & A. B. Tower of Holyoke, Mass., are drawing plans for a new paper mill at Ashland, N. H., for Wilder & Company of Boston, to take the place of one destroyed by fire recently. The mill will have two machines and two rag engines.

The proposed reduction of 10 per cent. in the wages of the skilled workmen at Dilworth, Potter & Co.'s spike mill, Fourth street, Pittsburgh, Pa., has been withdrawn, and each turn of employes is working three days each week at the old wages.

The *Worcester* (Mass.) *Spy* says: The Pond Machine Tool Company have this week shipped to Michigan, for the Calumet and Hecla Mining Company, a 50-ton iron planer, the largest ever made in Worcester. It is 25 feet long, and will plane 84 inches square. Four cars were used to transport it.

The Atchison, Topeka and Santa Fe railway has recently ordered from the Dean Steam Pump Company of Indianapolis, through the Chicago house of the latter company, a duplex compound pumping engine having a capacity of 1,000,000 gallons daily, and which is subject to a working pressure of 160 pounds.

L. M. Moyes, 37 Dey street, has recently assumed the New York agency for the Lowe boilers and feed-water heaters, built by the Bridgeport Boiler Works, Bridgeport, Conn. A new pamphlet, "History of Feed-Water Heaters," including considerable additional reading matter, has just been issued and will be sent free on application.

J.W. Adams & Co., Chicago, Ill., have issued a new illustrated catalogue of their open-head, solid-die, automatic bolt-threading, and nut-tapping machines. They announce that new and valuable improvements have been made since the publication of their catalogue last spring. They claim to make the only bolt cutter in which the quality and reliability of the work closely approaches that performed by the lathe.

The *Iron Trade Review* says: The Acme Machinery Company have just opened business at their large works, corner of Belden and Hamilton Streets, Cleveland. They will manufacture the celebrated Acme Bolt Cutter, besides nut machinery, headers, etc. Their works are all of brick, two stories high, 40x120 feet. They have placed in their works some of the best make of tools in the country, and no shop in the State is better equipped.

James Clark & Company, Baltimore, Md., have issued a new descriptive catalogue of the Moore System of water tube safety steam boilers. The boiler is fully illustrated, and its advantages. It is claimed that the first inventor of the water tube safety steam boiler was Charles Moore who took out a patent in England in 1824. The polygonal tube boilers made by this firm are tested to eight hundred pounds per square inch, cold water pressure.

The proprietors of the foundry and machine works, Sioux City, Ia., have nearly completed their new foundry. The building is 52x90 feet, with two cupolas and all the latest improvements. They have also built a new addition to the machine shop 55x50 feet, erected new boiler shop, 42x70 feet, new engine and boiler rooms, and tool rooms, all of brick and in first-class style. They will put in new pulleys, boring and stationary machinery, 12-foot planer, 15-inch shaper, 26-foot bed, and 26-inch swing shafting lathe, radial drill, pulley driller, and other tools.

Skinner & Wood, Erie, Pa., write us: Last week we had the pleasure of entering orders for four 60-inch boilers for the new electric light station at Elmira, New York, for which the Buckeye people furnish a pair of their engines; also a double engine 40-horse power for the new Kimball House, Atlanta, Ga.; a counterpart of the outfit we gave the Atlanta Constitution last spring. The Kimball House also takes one of our 10-horse power engines for laundry purposes. We also now have in preparation one of our new 50-horse power "Titan" outfits for Luther Gordon & Son, Brockport, N. Y.

The M. C. Bullock Manufacturing Company, Chicago, Ill., write us: We beg to advise you that we are erecting a large pair of hoisting engines, with 10-foot drums, and a plant of air-compressors and rock drills, for the Spring Valley Coal Company, of Peru, Ill. We have also just recently started two fine installations of Brush electric lights at Marinette, Wis., and Menominee, Mich., the latter driven by one of our Straight-Line engines. We are also just filling a large order for shafting, pulleys, and hangers for the Pullman Parlor-Car Company, making the second order from them within a year. We have also just recently received an order for six of our Sweet's Straight-Line engines for the new Board of Trade building in this city. We received this order in the face of very sharp competition, on account of the superiority of our engines. We are also in receipt of an order from the Straight-Line Engine Company, of Syracuse, N. Y., for a 90-horse power Straight-Line engine. This is "carrying coals to Newcastle," to build Straight-Line engines for the Straight-Line Engine Company. We have also closed an arrangement with the Gowan Car-Wheel and Tool Company, which gives us the sole and exclusive right to manufacture and sell their new car wheel boring, grinding, and truing machines for the United States.

The Westinghouse Machine Company, of Pittsburgh, Pa., issue a circular saying that the company will no longer solicit sales direct from the customer. The capital and energies of the company will be concentrated strictly upon the manufacture of Westinghouse engines, the sales of which have been phenomenal. The effect of this arrangement is practically to double their working capacity, insure the carrying of a larger stock of engines for immediate shipment, and to reduce the cost, also to give the customer the advantage of counsel with an expert salesman. Fairbanks, Morse & Co., of Chicago, in connection with Fairbanks & Co. of St. Louis, control the product for the Western States and Territories; Parke & Lacy, of San Francisco, Portland, and Salt Lake City, for the Pacific slope; and Imray, Hirsch & Kaeppel, of Sydney and Melbourne, for Australia and Oceanica. The trade heretofore controlled by the branch office at 94 Liberty street, New York, has been transferred to Westinghouse, Church, Kerr & Co., who have opened offices at 17 Cortlandt street. The firm is composed of H. H. Westinghouse (president of the company), William Lee Church, Walter C. Kerr, and I. H. Davis, all engineers and men of business. The new firm's circular announces their business as "contracting and consulting mechanical engineers controlling the manufacture or sale of approved specialties." They intend to purchase and control some of the best specialties in machinery and steam engineering. They will in all cases recommend, as engineers, the best article for the situation, whether in their special list or not. As Westinghouse engines are now built only to 300-horse power, they will contract for heavy plants, from 200 horse power upwards, using such other standard automatic engines as may be best adapted to each case.

J. Stevens & Company, Chicopee Falls, Mass., write us: "From the 8 line notice of our new catalogue which you gave us we have had several hundred calls and propably more which we could not trace." Those who wish to obtain their catalogue of improved calipers, dividers, gauges and small machinist's tools should address a postal card to the above firm, Box 1200, Chicopee Falls, Mass.

Machinists' Supplies and Iron.

NEW YORK, October 30, 1884.

The past week has brought forth no new features to the condition of the supply trade. The hopes of great improvement to meet the demands of fall business show no indication of being realized.

Fraser & Chalmers, Union and Fulton streets, Chicago, makers of mining and refrigerating machinery, are getting out a new illustrated catalogue.

The pig iron market retains the unsatisfactory conditions it has held for the last year. Unless for the best Lehigh brands, there has been a tendency to break on prices during the last week. Standard Lehigh and North River brands of No. 1 X Foundry are quoted at $19.50 to $20.50, but other brands can be bought for 50c. less. No. 2 X Foundry $18 to $19. Grey Forge $15.50 to $16.50, with little call for either.

Scotch pig is in little demand the market being dull and irregular. We quote Shotts $21.50 to $21.75, to arrive; Coltness $22, to arrive; Cambroe $20 50, to arrive; Eglington $19.50; Dalmellington $19.50.

Copper—The market for ingot has been dull, with very few sales. Lake is held at 13c., but it can be bought ¾ of a cent lower.

Lead—Common pig has been quiet, with prices lower than last week, sales having been made at 3.65c.

Tin—This market is dull, with little disposition for business. We quote, for jobbing lots, Banca 19¼c. to 19⅞c; Straits and Malacca 16¾c. to 17c.

✻WANTED✻

"Situation and Help" Advertisements, 30 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Situation wanted by first-class pattern maker and mech'l draftsman. Can furnish good references. Address Wm. Hultgran, 184 McGregor st., Chicago, Ill.

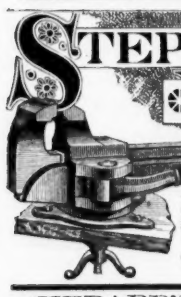
A practical, licensed engineer, thoroughly experienced with dynamos, electric lights, and high-speed automatic cut-off engines, wants a situation. Address "Engineer," 1214 Brown st., Phila., Pa.

Wanted—A foreman to take charge of a boiler shop. One who thoroughly understands all classes of boiler work; none other need apply. Address, giving references, "Foreman," care AM. MACHINIST.

Wanted—A young man, having experience as draughtsman, on automatic cut-off engines and general machinery. Applicant to address P. O. Box 3083, New York City, giving references, experience, age, and salary expected. Location of shop is healthy and pleasant, about fifty miles from New York City.

Wanted—A good second-hand punch and shear combined, for boiler work. Tozer & Dial, Columbia, S. C.

STEPHENS PATENT VISES.



50 Per Cent. of time and labor saved by using this solid, strong, durable, quick-working Vise. Has the improved taper, pipe and other attachments. Sold by trade. Send for circular.

MELVIN STEPHENS, Prop'r, Office, 41 Dey Street, New York.

SHEPARD'S CELEBRATED

$60

Screw Cutting Foot Lathe.

Foot and Power Lathes, Drill Presses, Scrolls, Saw Attachments, Chucks, Mandrells, Twist Drills, Dogs, Calipers, etc. Send for Catalogue of outfits for amateurs or artisans. Address

H. L. SHEPARD, AGENT, 134 E. Second St., Cincinnati, O.

ROUGH PULLEYS

at 2½ cents per pound, to close out stock on hand.

Send for printed list of dimensions.

THE JOHN T. NOYE MFG. CO., Buffalo, N. Y.

HILL, CLARKE & CO.

36 Oliver Street, Boston, Mass.

Branch Office and Storehouse,

800 N. SECOND ST., ST. LOUIS, MO.

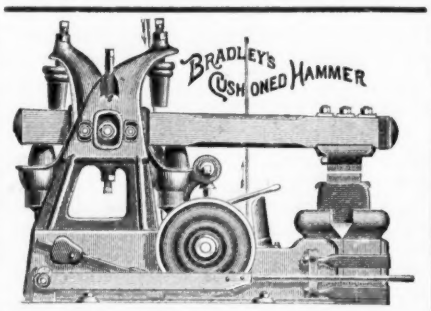
MACHINERY FOR SALE.

SECOND-HAND.

One Putnam Screw-Cutting Engine Lathe,

42 Inch Swing. 26 feet bed, all complete, in fine condition.

Catalogues of New Machinery on Application.



Bradley's Cushioned Hammer

Stands to-day WITHOUT AN EQUAL.

OVER 800 IN USE.

BRADLEY & CO., Syracuse, N. Y.

ESTABLISHED IN 1832.

JUST PUBLISHED.

Dynamo Electric Machinery:

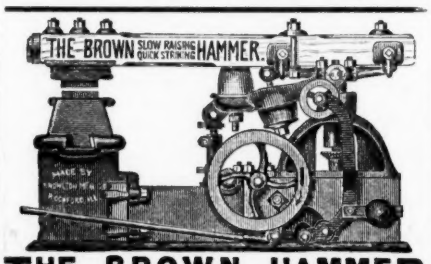
A Manual for Students of Electrotechnics.

BY SILVANUS P. THOMPSON, B.A., D.Sc.

388 pages, 8vo, cloth, illustrated by 230 engravings.

Price, $5.00.

E. & F. N. SPON, 35 MURRAY STREET, N. Y.



THE BROWN HAMMER

STRIKES A BLOW WITH

DOUBLE THE VELOCITY That it Raises the Hammer.

A NEW MOVEMENT! SEND FOR DESCRIPTION.

KNOWLTON MFG. CO., King St., Rockford, Ill.

BEVEL GEARS,

Cut Theoretically Correct.

For particulars and estimates apply to

BREHMER BROS., *Machinists,* 440 N. 12th St., Philadelphia, Pa.

MACHINERY

For Reducing and Pointing Wire.

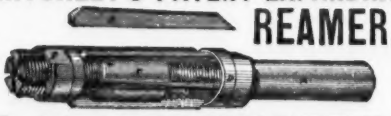
Especially adapted to pointing wire rods and wire for drawing.

For Machines or information, address the manufacturer,

S. W. GOODYEAR, Waterbury, Ct.

CRITCHLEY'S PATENT EXPANDING

REAMER.



Manufactured by PORTSMOUTH MACHINE CO.

Successors to Critchley & Whalley,

Send for Circular. PORTSMOUTH, N. H.

The Deane Steam Pump Co.,

HOLYOKE, MASS.

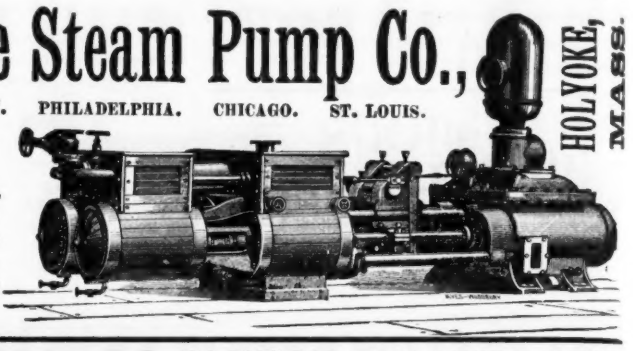
NEW YORK. BOSTON. PHILADELPHIA. CHICAGO. ST. LOUIS.

MANUFACTURE

PUMPING MACHINERY

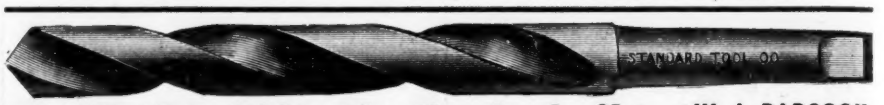
FOR ALL DUTIES.

Send for New Illustrated Catalogue.

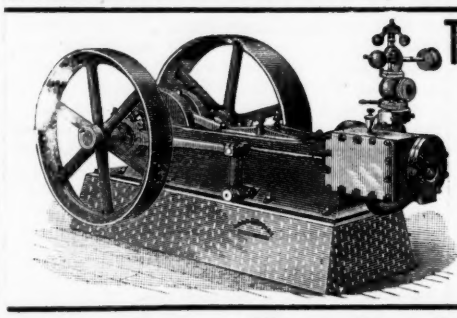


FRICTION CLUTCH PULLEYS AND CUT-OFF COUPLINGS.

JAS. HUNTER & SON, North Adams, Mass.



STANDARD TOOL CO., Cleveland, Ohio. W. A. BABCOCK. Manager.



The LANE & BODLEY CO'S

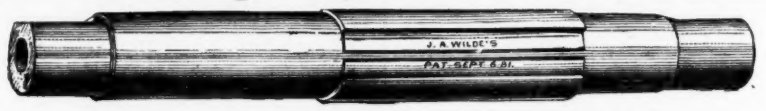
HIGH SPEED BALANCED CENTER CRANK

STEAM ENGINES.

A most complete and durable engine, fully equal to the demands of the times for high speed and continuous service. Sizes, 7 in., 8-in., 9-in., 10-in., 12-in. and 14-in. cylinders. Address

THE LANE & BODLEY CO., Cincinnati, O.

Wilde's Patent Expanding Mandrel Is the Most Perfect Novelty out. SIMPLE, INEXPENSIVE, ACCURATE.



COOKE & CO., 22 Cortlandt Street, NEW YORK.

Sole Agents and Dealers in General Machinery and Supplies.

—) PLEASE MENTION THIS PAPER. (—

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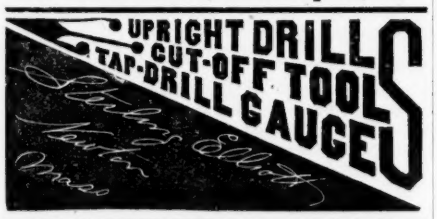
Hoisting Engines and Hoisting Machinery,

D. FRISBIE & CO.,

481 North 5th St., Philadelphia, Pa.



SCHÖNHEYDER'S

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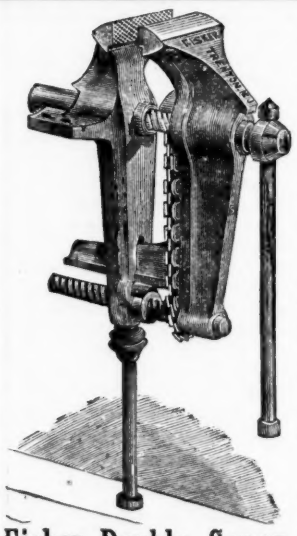

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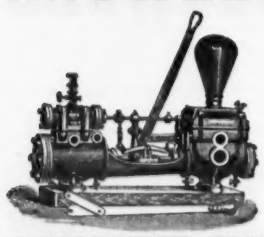

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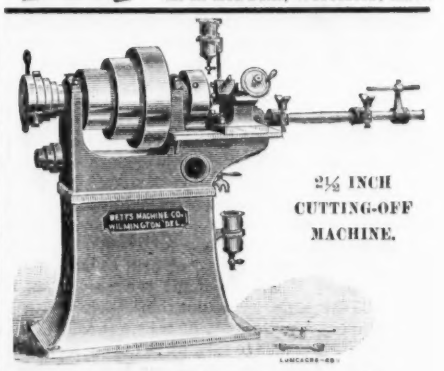

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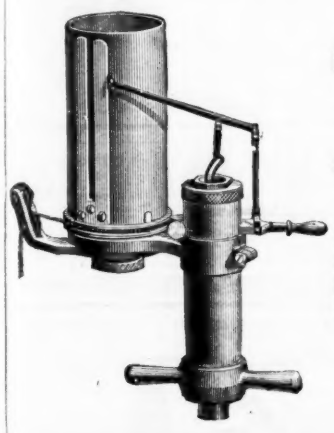

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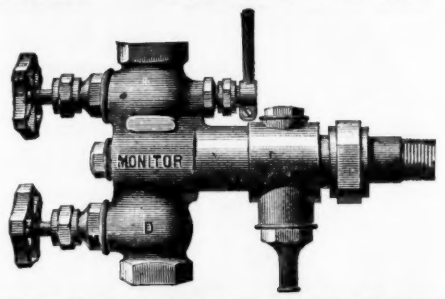

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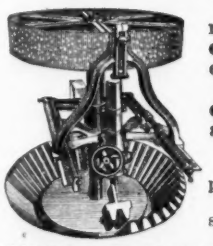

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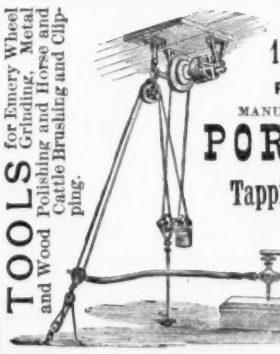

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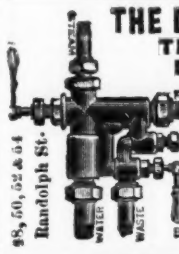

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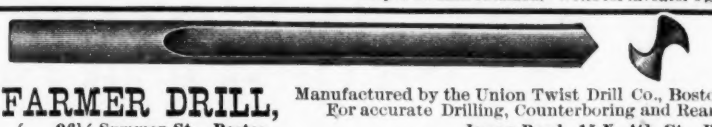
PATENTS! Thomas P. Simpson, Washington, D. C. No pay asked for patent until obtained. Write for inventor's guide.



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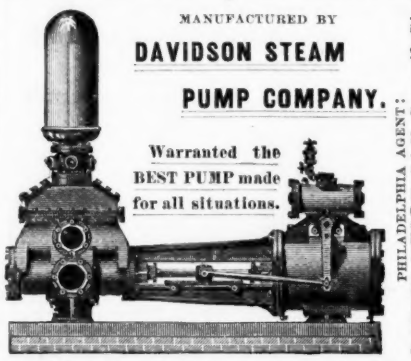

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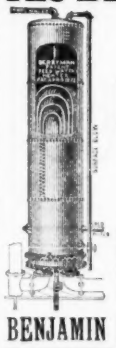

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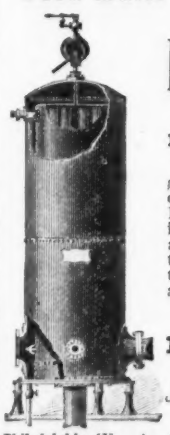

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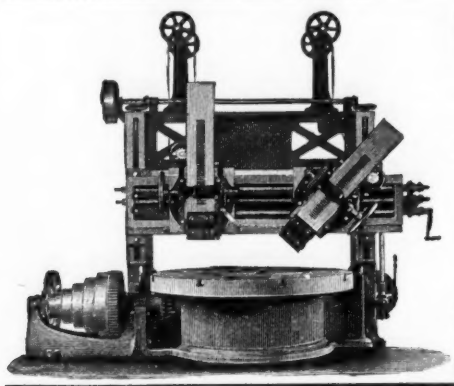

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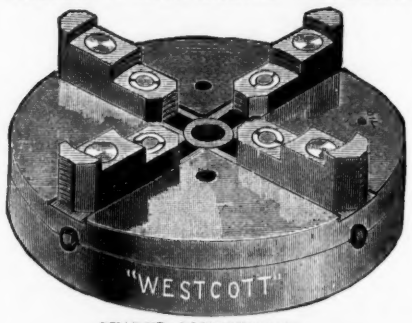

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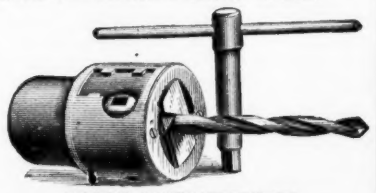

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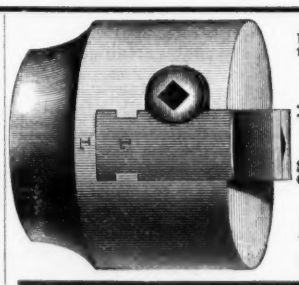

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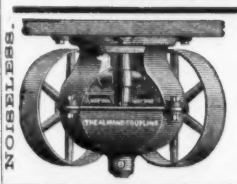

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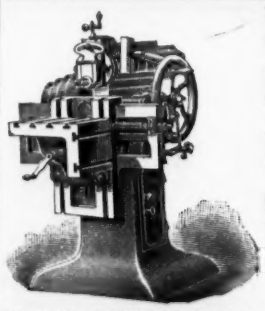

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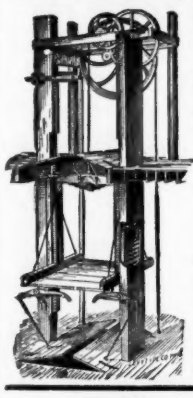

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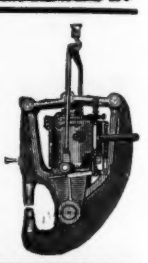

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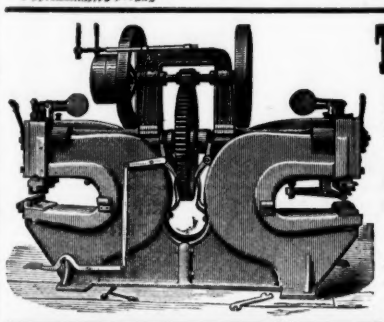

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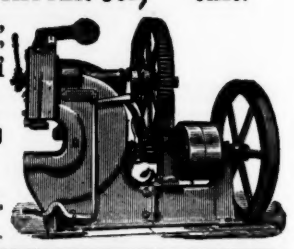

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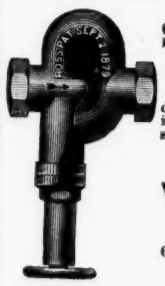

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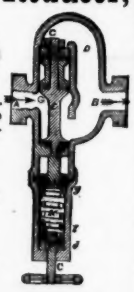

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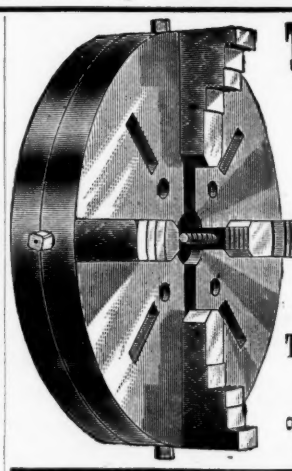

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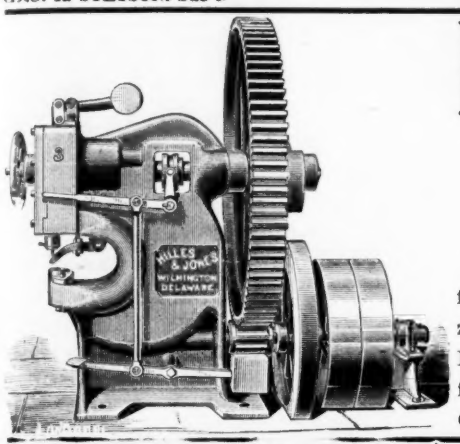

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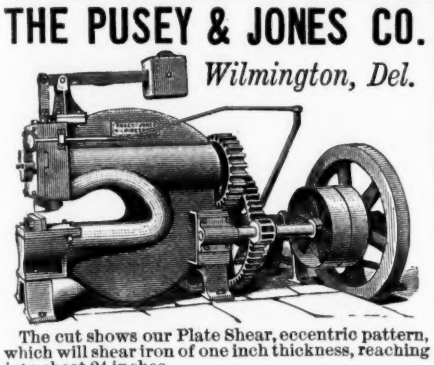

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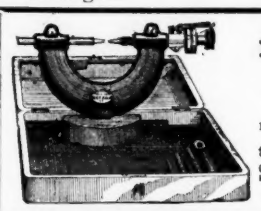

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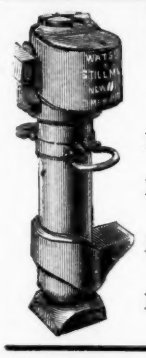

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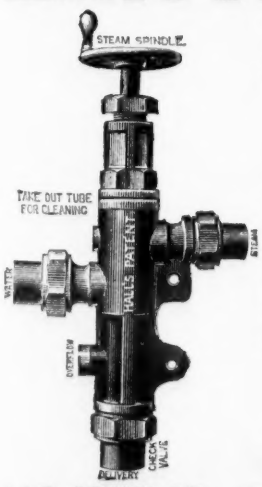

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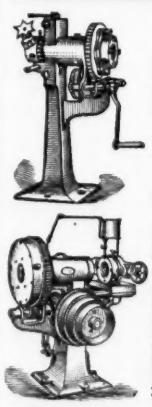

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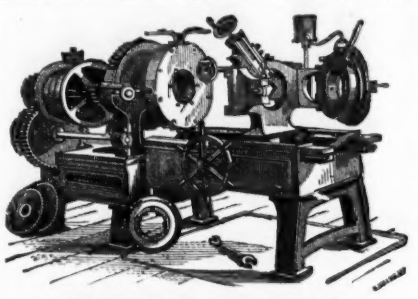

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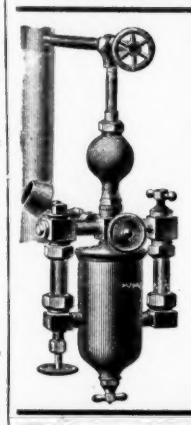

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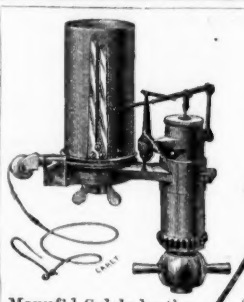

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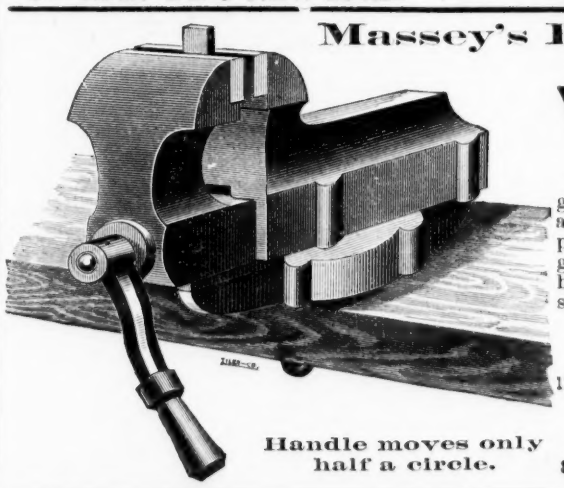

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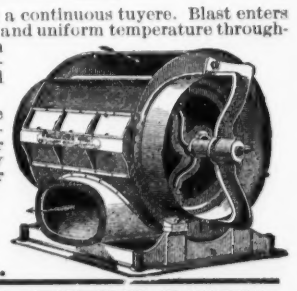

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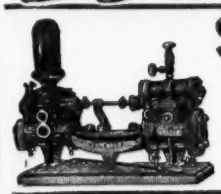

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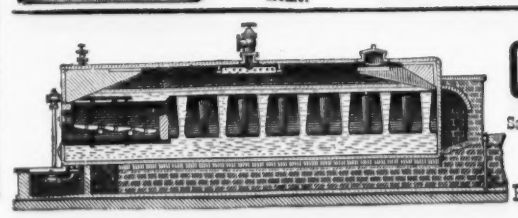

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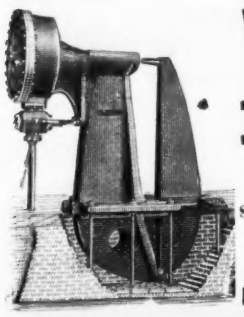

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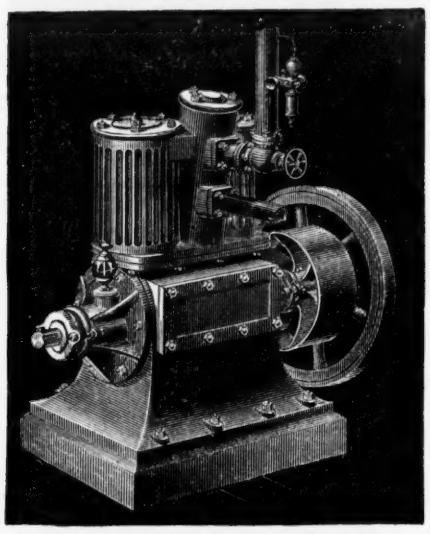

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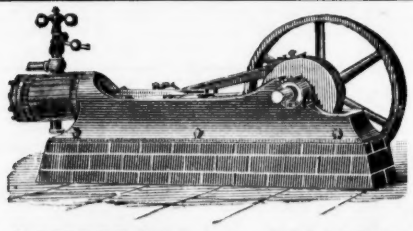

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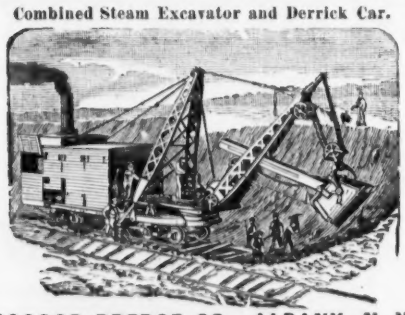

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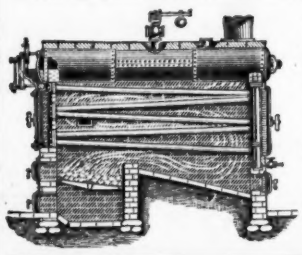

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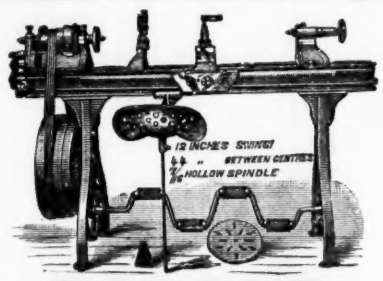

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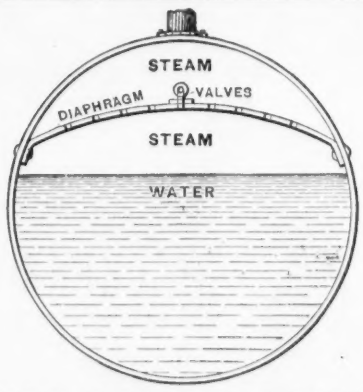

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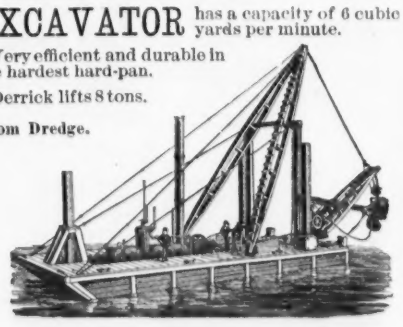

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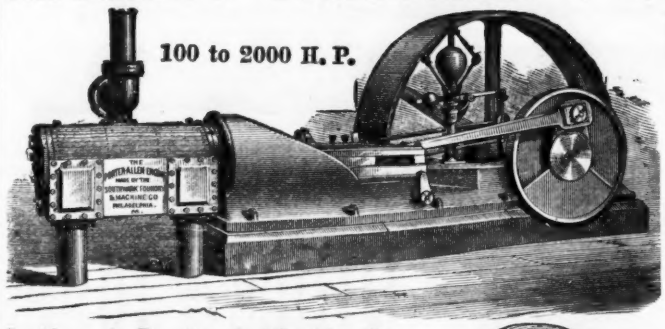

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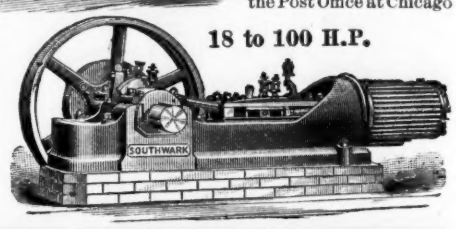

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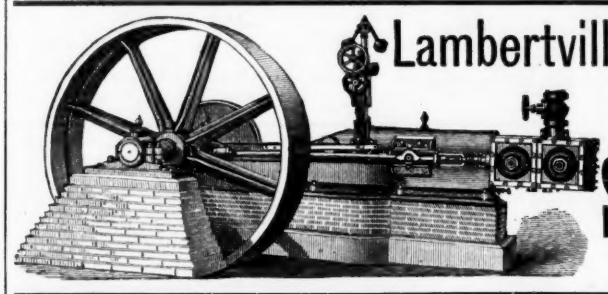

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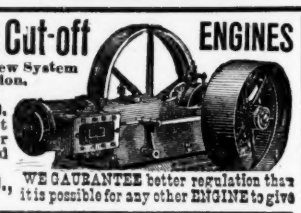

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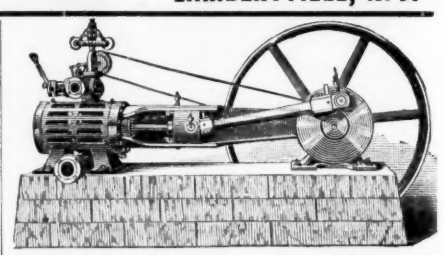

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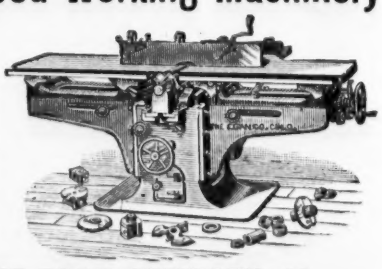

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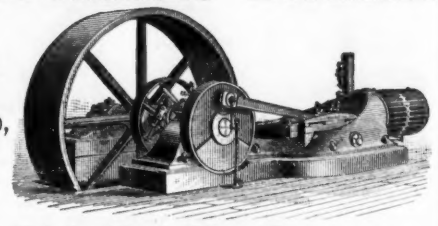

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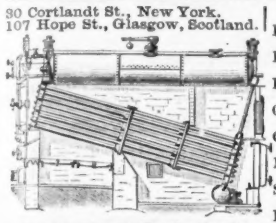

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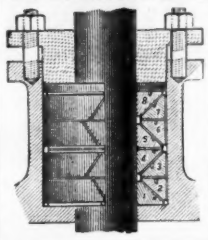

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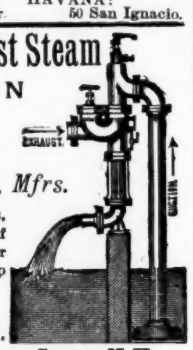

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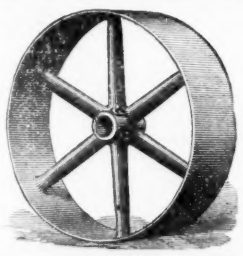

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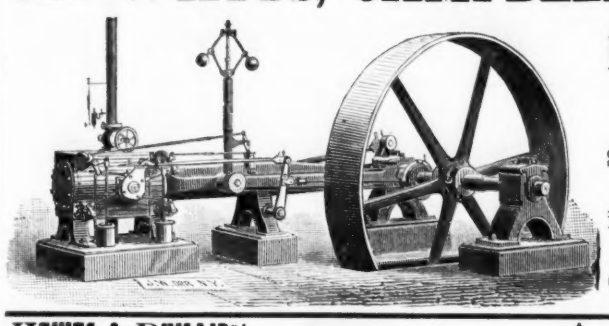

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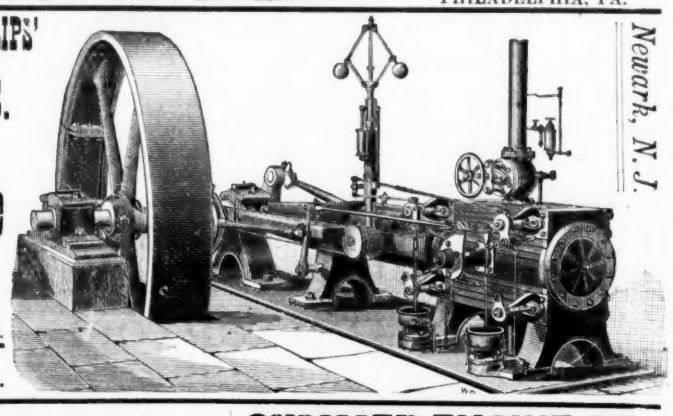

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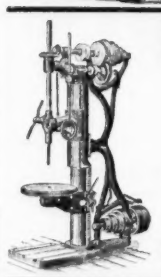

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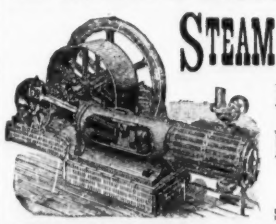

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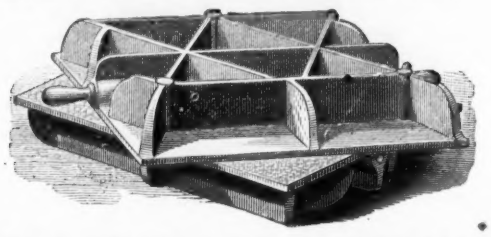

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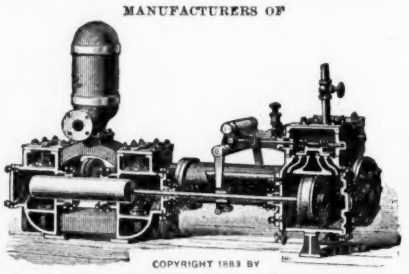

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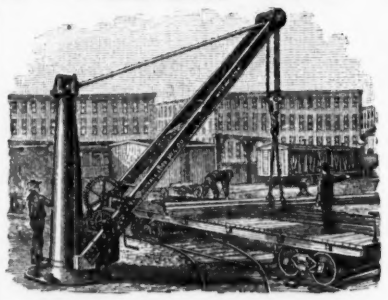

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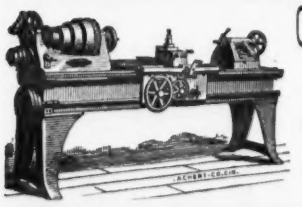

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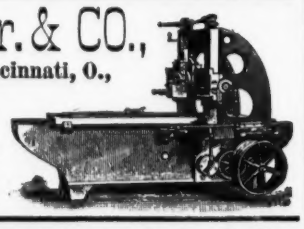

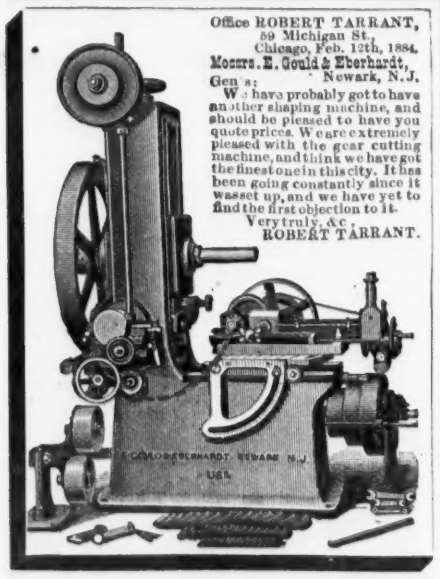

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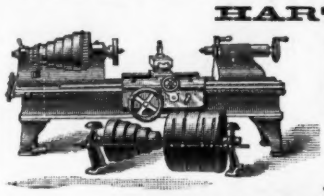

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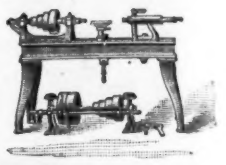

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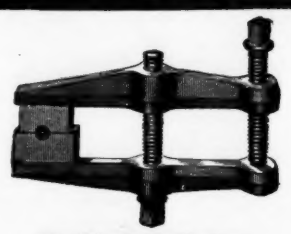

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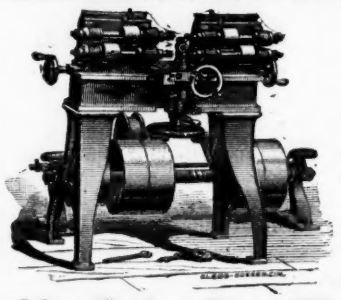

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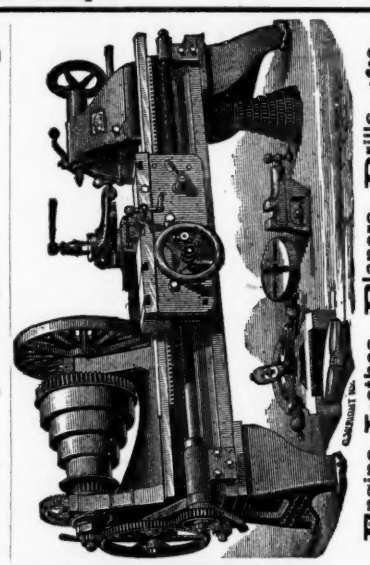

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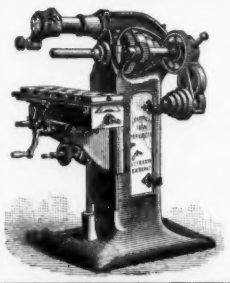

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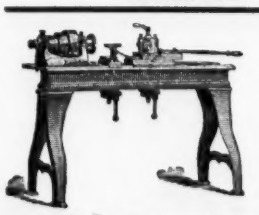

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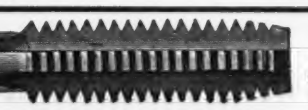

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